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a journal for precision engineers and all users of industrial diamonds and other hard materials

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MICROSTRUCTURES OF DIAMOND SURFACES

By S. Tolansky, D.Sc., F.R.S.

Read what the Reviewers say about this important book :—

This is a delightful book : firstly because it is a record of a piece of highly individual research by one school supervised and inspired by one man ; secondly, because it is superbly illustrated. Indeed, although the letterpress is easy to read, the ideas being clearly and simply expressed, it is probably the plates that will sell the book . . . Prof. Tolansky has developed new and very powerful optical techniques which actually reveal and enable him to measure surface steps or discontinuities of as little as 10 A., the effective useful magnification in such a case being X 500,000. . . . Cleavage, polishing, etching and sawing of diamond faces, octahedral, cubic, and dodecahedral, are all discussed in the light of really remarkable photographs, and some information is given on the difficult problem of " the two types of diamond."—Kathleen Lonsdale in " Science Progress."

Prof. Tolansky has been well served by the Goldsmiths' Press, whose wide experiences of diamond publishing has doubtless contributed to the success with which they have reproduced so many of his magnificent photographs of diamond surfaces. . . . Although all these methods are simple applications of well-known optical principles, it has remained for Prof. Tolansky to develop them into an extraordinary powerful array, needing skill to be sure, for their successful application, but comparatively little equipment beyond a good optical microscope to obtain one-dimensional resolution which compares favourably with that of the electron microscope. . . . The appearance of this book will be a welcome stimulant to many engaged in diamond research. It also provides valuable data for comparison with the artificial crystals of germanium and silicon, on which such an immense amount of effort is now being expended by the electrical industry. Since the stages of growth can actually be followed for these metals, comparative studies might well resolve some of the fascinating problems so literally brought to light by Prof. Tolansky's researches.—H. J. Grenville-Wells in " Laboratory Practice."

To those who use diamond as a tool, the information in the last two chapters, on " ring-crack " damage to diamonds, and on the surface condition of mechanically polished diamonds, should be specially worthy of study."—F. C. Franks.

Some of the traditionally accepted facts about diamond surfaces have been contradicted by Prof. Tolansky since he began studying the gem in his laboratory. His recent observations are described in " Microstructures of Diamond Surfaces." He reports, for instance, that tradition has it that diamonds have a perfect cleavage in particular directions. From optical studies of cleavage surfaces he says that " the cleavage is optically very far from perfect except in one type of diamond."—" Tooling and Production," Huebner Publications Inc.

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The Optical Techniques
Some Characteristics of Diamond
The Topography of the Natural Octahedron Faces
The Nature of the Trigons
Some Growth Features on Octahedron Faces
Linear Discontinuities on Diamonds (Slip ?)
The Etching of Diamond
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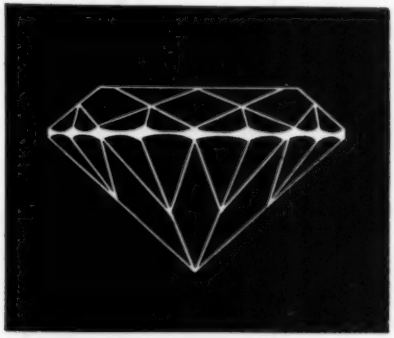

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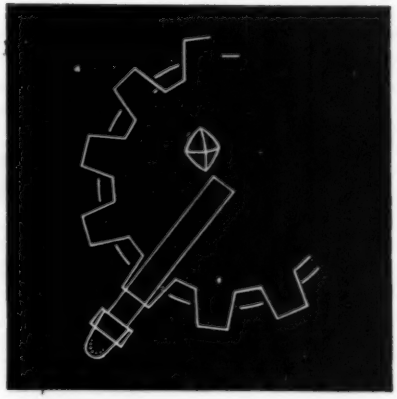

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Generally Speaking

Ageless Diamonds

Although principally devoted to cut gem diamonds, the exhibition at Christie's this month under the title of "The Ageless Diamonds" had a considerable section devoted to rough stones and to industrial diamonds both in the rough and as finished tools. In addition, a series of photographs illustrating the uses of the tools on show formed a background to the display. Inevitably, the chief attraction to the general public was the gem display, with the many outstanding stones from Royal and other collections, but in this way many people who have probably never given a thought to the industrial uses of diamonds have been given an introduction to the subject.

Two Centuries Plus

In connection with the title of the exhibition, it is interesting to record that there is, in the possession of the Gemmological Association, a commercial document of the mid eighteenth century recording certain transactions in the trade between London and the Far East, two of the items to be brought back being gem diamonds and diamond boart. This is one of the earliest references to diamond boart that we have seen, and we shall publish a reproduction of the document, with a description, in next month's issue. If any of our readers knows of any similar early references to diamond boart or to industrial uses of diamond, we should be interested to have details.

The New Classification Scheme

As we promised in an earlier issue of the *Industrial Diamond Review*, we are including in this month's *Industrial Diamond Abstracts* a short note on the new classification system being brought into use in the Industrial Diamond Information Bureau. In future, all the items in the *Abstracts* will be classified according to this scheme, which permits of far closer definition than did the old system.

ADAMANT.

Diamond Dodecahedra—Some New Observations

by ***Prof. S. Tolansky, D.Sc., F.R.S***

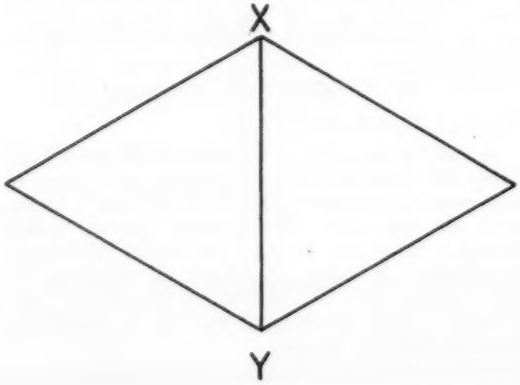
Introduction

In this report a preliminary account will be given of some new surface studies on diamonds now under examination in my laboratory. A much more detailed account will be communicated elsewhere. This account is restricted to reporting some curious new findings concerning the surface microstructures of dodecahedral diamonds (made in conjunction with Mr. D. C. Pandeya). In this laboratory, for several years past, we conducted an energetic examination of the microstructures of the *octahedral* faces of diamond, and formed a number of general conclusions regarding both growth and etch. We have now directed our attention to *dodecahedra*, having secured a considerable number of fine dodecahedral diamonds whose natural surface qualities permit of the application of precision optical techniques for the study of their microstructures and microtopographies.

Occurrence of dodecahedra

At times, conflicting statements have been made as to the frequency of occurrence of dodecahedra. It now seems clear that whilst in some mines the output contains a strong preponderance of octahedra, on the other hand, in others, the dominant type is dodecahedra. Thus it is that general statements of frequency of occurrence from mixed outputs are apt to be misleading. This change of habit in different mines has not been at all fully examined and deserves a very intensive study in relation to other minerals present, in that this may well throw light on growth mechanisms. It is with this background in view that I have undertaken an intensive attack on the examination of the microstructures of diamond dodecahedral faces.

Fig 1. Dodecahedral face of diamond.



First experimental method

Now in general, diamond dodecahedral faces, which often have a shape like Fig 1, are strongly curved, and this imposes difficulties in the use of high power microtopographical studies. In my laboratory three principal methods are being used for this purpose; these will be indicated very briefly since they have formerly been described in detail. First, low and high power microscopy is employed, including oblique, dark ground and phase-contrast illumination methods. These direct microscopical studies (from $\times 10$ to $\times 3000$) are very much assisted and improved by first coating the diamond with a highly uniform thin silver film. This is put on by thermal evaporation in a high vacuum. The silver is a mere half-a-millionth of an inch thick. It is extremely uniform and we have repeatedly established that such a silver film contours the whole surface microstructure with such remarkable fidelity as to approach molecular exactness. It certainly does not introduce artefacts.

Now this perfection in contour has an interesting result. Imagine a surface of a diamond to consist of two regions, one of which is naturally smooth, with a high natural polish, or rather with a high specular reflectivity, and the other a region that is rough or ' matt ', (on a microscale, of course). When the silver goes down on the *smooth* part it naturally increases the reflecting power of that region to nearly 100%, hence this part reflects back a lot of light when it is illuminated. But we have demonstrated that when silver goes down on a *matt* surface it still remains matt, as the silver accurately contours the microhills and dales of the matt region. It therefore appears merely ashen grey and not bright, for the light is still scattered from it in different directions and is not at all specularly reflected. Thus it is that under a microscope *used with reflected light* a very great enhancement in contrast is created respectively between the smooth specularly reflecting and the matt regions. Microstructure details now appear with great clarity although they may be invisible in transmission, and also often not detectable with reflexion microscopes if no silvering has been used.

The silvered crystal surfaces are then examined in reflexion with a metallurgical type microscope

(Vickers projection microscope) equipped with white and monochromatic sources, and with a variety of types of illumination. It is re-emphasized that much of the structure described here would usually be missed if the silvering were not carried out.

Second experimental method

The second experimental method involves *multiple-beam interferometry* of two kinds, and these will be only very briefly indicated. Multiple-beam interference techniques (which were created in my laboratory) are optical procedures which give an optical micro-contour map of a surface and reveal the microtopography in the up and down direction with an accuracy and sensitivity which approaches molecular dimensions. In the up-down direction it is even *more* sensitive than a costly electron microscope, and can readily resolve height differences of 10 AU, *ie* 1/25,000,000th of an inch. To do this, a very careful technique is required. The equipment is simple but the optical conditions are very stringent and exacting; indeed a real ' know how ' is needed.

Briefly, the crystal to be examined is coated with a thin layer of silver. It is then held very close to a prepared glass optical flat which is coated with a *critically* made thin reflecting layer, which is slightly transparent. This layer may be either of silver or alternatively of a complex dielectric system of alternate layers of zinc sulphide and cryolite. Its reflexion and absorption characteristics are critically important and must be just correct. This arrangement can be illuminated with either parallel monochromatic light or with parallel white light, and these two illuminations lead to two very different techniques. When correctly illuminated with parallel monochromatic light at normal incidence (through a reflecting microscope) one secures a micro-picture of the diamond on which are superposed what are called *multiple-beam interference fringes*. These arise through the reflexion of the light to-and-fro many times (say 100 times or more) between the silvered diamond surface and the treated optical flat surface. In effect, the micro-picture is covered with contour lines which very closely resemble the contour lines in a typical geographical map, but with a difference ! The difference is one of scale. On our geographical map the surveyor's contour lines may represent height changes of 100 feet. Our interference fringes, our *optical* contour lines, because of the smallness of the light wave, each correspond to a height change of 1/100,000th of an inch. By a critically correct technique these optical contours can be made so sharp and narrow that height alterations causing a mere displacement in the contour of 1/250 of the separation between contours, can be detected. This is how the aforementioned accuracy of 1/25,000,000th of an inch is achieved. The accuracy attainable depends primarily on the correctness of the optical conditions ; small deviations from correctness have a big influence.

The second interference technique, that using white light, is more elaborate, in that the light coming from the microscope does not show any contour effect at all until it is sent through a spectroscope. Then it reveals the micro-profile, not of an area of the crystal, but of a single, quite narrow, line section. This is a powerful adjunct to the topographical contour map method, and solves numerous difficulties often encountered in microtopographical interference fringe patterns. It gives an optical section; as if a mountain were sliced by a vertical plane, and the skyline seen.

Third experimental method

So far, the techniques described are non-destructive, for the thin silver film can easily be removed from the diamond without producing the slightest alteration of the surface. (A good way is to use hydrogen peroxide. Repeated cleaning with this reagent, which easily and rapidly dissolves silver, has absolutely no effect whatsoever on a diamond surface, which is completely resistant to this mild reagent, even down to a molecular scale).

The third technique we use, *etching*, is partially destructive, and therefore only employed when maximum information has been secured by all other methods. It is, of course, only used occasionally, for a technique which destroys the very surface being studied is highly undesirable in principle. Nevertheless it is very powerful and certainly has justified occasional use. I am referring here to *very carefully controlled* etching, the conditions of which have been precisely worked out in my laboratory. Despite numerous earlier reports on diamond etching (which, indeed, even go back to Robert Boyle in the mid-seventeenth century) we have found that an adequate etch can be produced at very much lower temperatures than was formerly believed. Slow etching can set in at about 500 deg C (it is extremely slow at 475 deg and no trace of etch appears at all below this) by immersing the diamond for about one hour in potassium nitrate. A rise by 50 deg C increases the rate rapidly. Now what we have found is that mild *slow* etching has an intensive selective effect on surface structures, even if so small as to be invisible even to precision interferometry. Micro-ledges and micro-discontinuites, indeed crystallo-

graphic boundaries and edges which I conjecture are of the order of a *single* crystal lattice spacing, accept the etch preferentially, and so an etch pattern develops which can reveal some unsuspected hidden microstructure which may even be merely on an atomic scale. Of course, if the etch is not critically controlled, it then runs away and eats up the very structures being sought for. Clearly this technique must only be used at the very end stages of the research, and even then in a most restrained fashion. For a surface once etched is permanently wrecked as a surface, even if the attack is only ' skin deep '. This low temperature etch has not yet run away with us but has always succeeded. Of course, we wrecked many surfaces before finding the correct technique, having been misled by earlier workers.

Earlier findings

Having briefly reviewed the precision microtechniques employed, a brief indication will be given of one or two of our earlier findings on quite a small number of dodecahedra, as an introduction to what we are now finding. First was the establishment of the existence of a geometrical pattern of solution networks, second that of etch ridges. The networks, which were found on most dodecahedral faces examined, had the appearance of an irregular kind of fisherman's netting. The net lines were very shallow channels enclosing small convex regions, and these net outlines were at times straight but more often curved, but *not*, in general, strictly crystallographically oriented. They do, however, often show a partial orientation, as will be indicated below.

In these further, much more widespread studies, we have indeed found numerous dodecahedral surfaces with such networks, an example being shown in Fig 2 (×150). Here the shorter diagonal of the face (XY of Fig 1) is the black vertical line at the extreme left. The network has clearly a kind of orientation relative to this. The irregular character of the network, which can have either a partial pentagonal or a hexagonal character, is shown on another face at a higher magnification (×400) in Fig 3.

Fig 2. ' Fisherman's netting ' network on a dodecahedral surface. (magnif ×150).

We have established that the regions between the network lines are shallow convex *hillocks*. It is to be noticed that the whole surface has an impure mottled character, and it is our opinion that a solution mechanism is responsible for the pattern, having etched away th observed line network, leaving hillocks between.

There is no doubt now, from our observations, that this type of network is fairly widespread on dodecahedra, and we can now produce numerous examples. We have, indeed, found them to be closely associated with other obvious etch and solution phenomena. Thus Fig 4 (×200) is but one example. Here we have the characteristic network; but we also have chains of etch pits lying in circular arrays. Although correctly oriented, these etch pits are not the shape one would expect on a plane dodecahedral face. I have formerly established by direct etching that

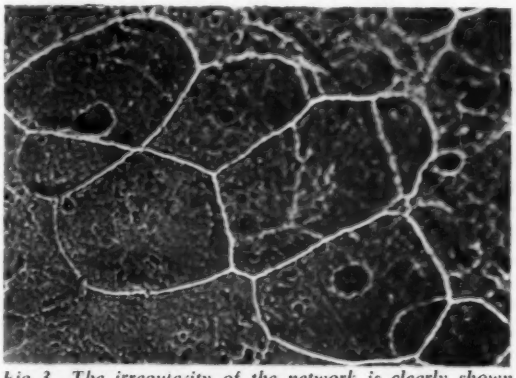


Fig 3. The irregularity of the network is clearly shown here. (magnif ×400).

on a dodecahedral *plane*, strictly symmetrical, sharp, doubly-pointed, boat-shaped etch pits are formed, with a sharp central ' keel ', having a perfect ' canoe ' shape. There are on these *two* planes of symmetry, *ie* AB and CD (see Fig 5a). Our present pits are indeed symmetrical but only about AB (see Fig 5b). Although of intrinsic interest they will not be discussed in detail in this report. Their shapes are shown to considerable advantage by the interferogram of Fig 6 (×240). They are irregular, and a typically large pit has a depth of some 5 light waves (say 1/10,000th of an inch). The bottom is flat, one

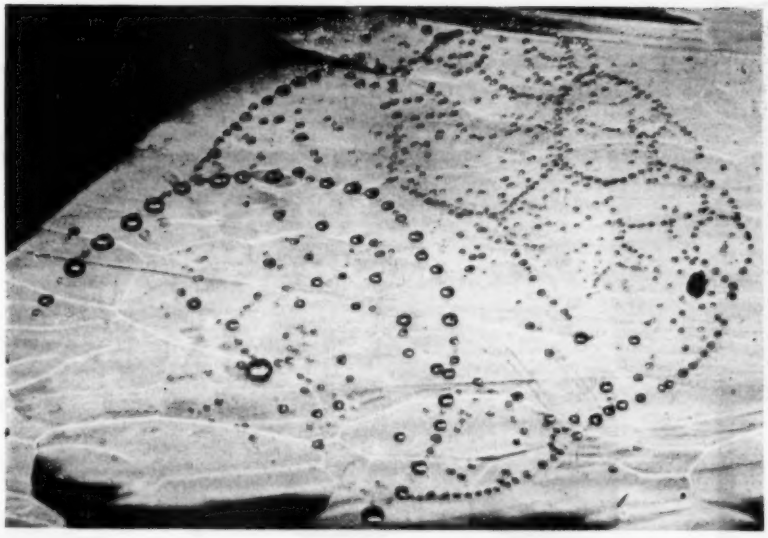


Fig 4. Characteristic network with chains of etch pits. (magnif ×200).

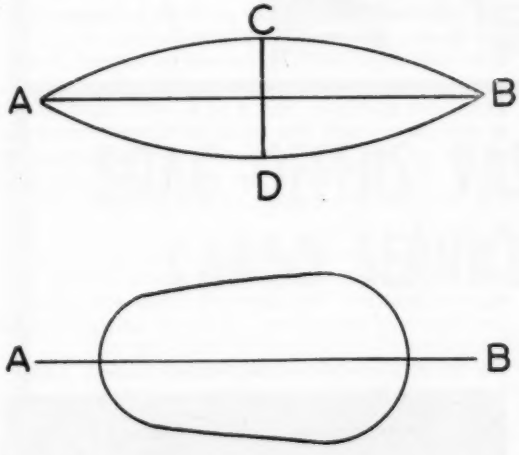


Fig 5 (a). The two planes of symmetry of a direct etched pit on a dodecahedral plane. (b) These pits are symmetrical only along AB.

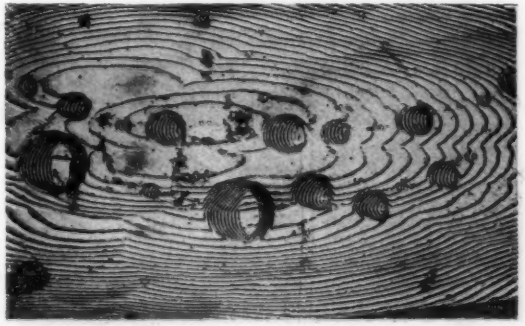
side can slope up at about 4°, the other at perhaps 12°, which is unexpectedly large on an interferometric scale. These will be discussed in detail elsewhere. Attention is drawn also to the fact that the dips in the general surrounding fringes correlate exactly with network lines, as shown in the associated micrograph, Fig 7 (×150), which refers exactly to the larger magnified area shown in Fig 6 (×240).

The particular shapes which the etch pits show are almos certainly due to the highly curved character of the face on which they appear. The face is by no means a true (110) dodecahedral *plane*; it is merely *dodecahedroid*, that is an approximation to the indexed (110) plane, and it is only to be expected that any etch pits will depart from the purely symmetrical patterns which we have formerly produced on the (110) plane itself. Having disposed of this difficulty, we see now that in fact the network is then very closely associated with direct simple etch. This is not the only example we have found, indeed it is one of several, all pointing to the fact that the networks are the result of etching or solution.

Different network found

I come now to a more striking type of network. In our earlier studies we found only one example of a strictly crystallographically orientated network pattern which was undoubtedly different from those just described. Here the network consisted of regular *linear* arrays of *four-sided*

Fig 6. Interferogram of types of etch pit shown in Fig 5b. (magnif ×240).



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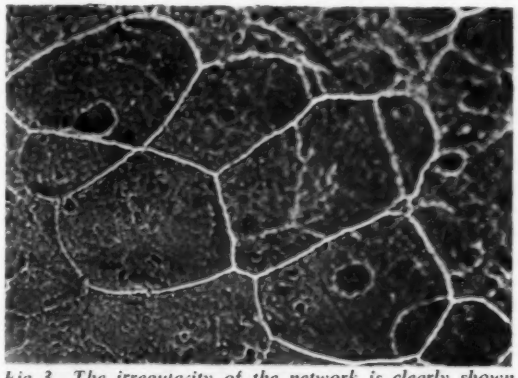

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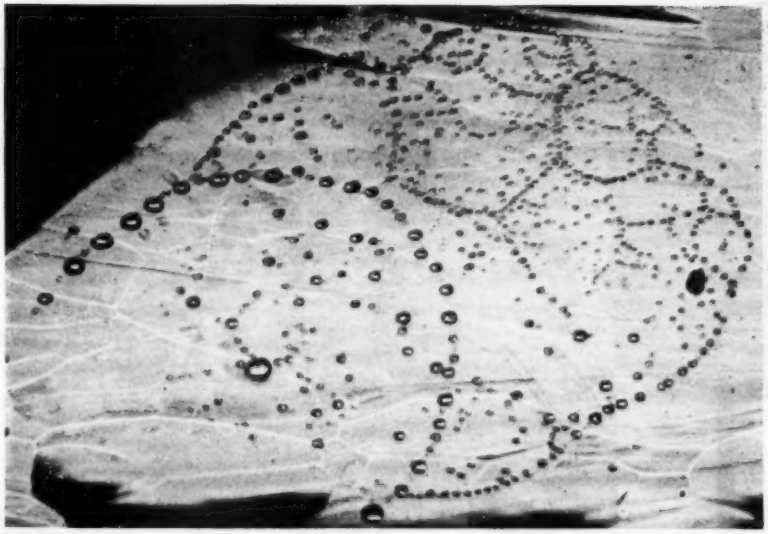

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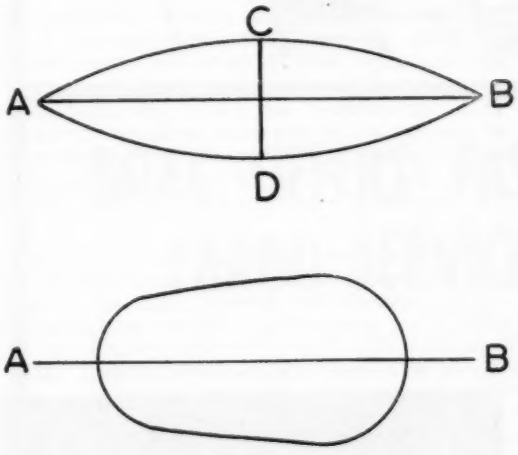


Fig 5 (a). The two planes of symmetry of a direct etched pit on a dodecahedral plane. (b) These pits are symmetrical only along AB.

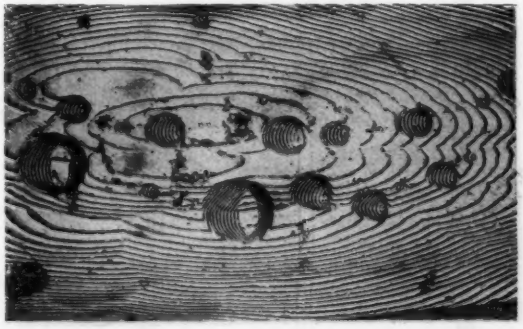
side can slope up at about 4°, the other at perhaps 12°, which is unexpectedly large on an interferometric scale. These will be discussed in detail elsewhere. Attention is drawn also to the fact that the dips in the general surrounding fringes correlate exactly with network lines, as shown in the associated micrograph, Fig 7 (×150), which refers exactly to the larger magnified area shown in Fig 6 (×240).

The particular shapes which the etch pits show are almos certainly due to the highly curved character of the face on which they appear. The face is by no means a true (110) dodecahedral *plane*; it is merely *dodecahedroid*, that is an approximation to the indexed (110) plane, and it is only to be expected that any etch pits will depart from the purely symmetrical patterns which we have formerly produced on the (110) plane itself. Having disposed of this difficulty, we see now that in fact the network is then very closely associated with direct simple etch. This is not the only example we have found, indeed it is one of several, all pointing to the fact that the networks are the result of etching or solution.

Different network found

I come now to a more striking type of network. In our earlier studies we found only one example of a strictly crystallographically orientated network pattern which was undoubtedly different from those just described. Here the network consisted of regular *linear* arrays of *four-sided*

Fig 6. Interferogram of types of etch pit shown in Fig 5b. (magnif ×240).



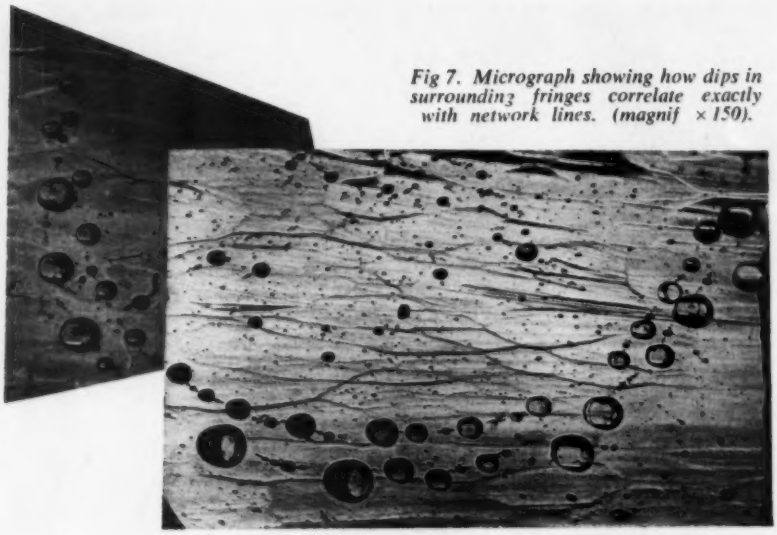


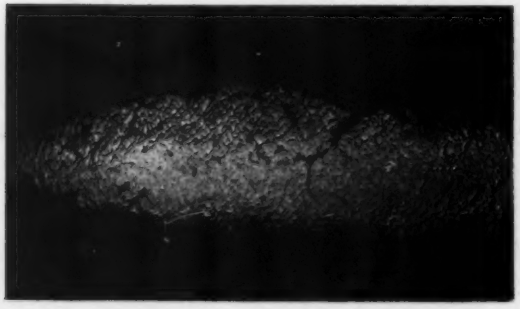
Fig 7. Micrograph showing how dips in surrounding fringes correlate exactly with network lines. (magnif ×150).

parallelograms all fairly strictly oriented on the face. We found only a single example, and we noted that this pattern appeared over only a small part of a face.

Now we have found numerous identical patterns on a number of faces of another four dodecahedral diamonds, and it is likely that this occurs a good deal more frequently than we considered to be the case formerly. Fig 8 (×200) is typical of our new observations. The parallelograms enclose angles of about 70½ and 109½°. They are occasionally bounded by curved lines, and especially at corners is there a tendency to curvature. These networks are often on a small scale and might well be missed by casual observation or without silvering to help the contrast. Thus, for example, Fig 9 is a ×40 photograph of one face which has on it rectilinear networks which are not too obvious. Yet a portion at ×480 (Fig 10) shows up the array admirably. The orientation relative to a crystal edge is shown in Fig 11 (×210).

Fig 8. New type of network consisting of regular linear arrays of four-sided parallelograms, all fairly strictly strictly oriented on the face. (magnif ×200).

Fig 9. Rectilinear networks not clearly shown. (magnif ×40).



There is evidence (although this is as yet under detailed examination) that on these crystals the regions between the network lines are *concave*, not convex, depressions. If that is so they would

Fig 10. New networks clearly shown. (magnif ×480).

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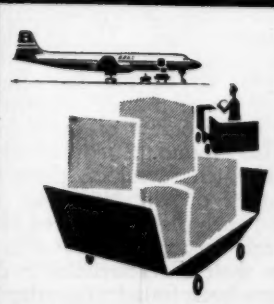

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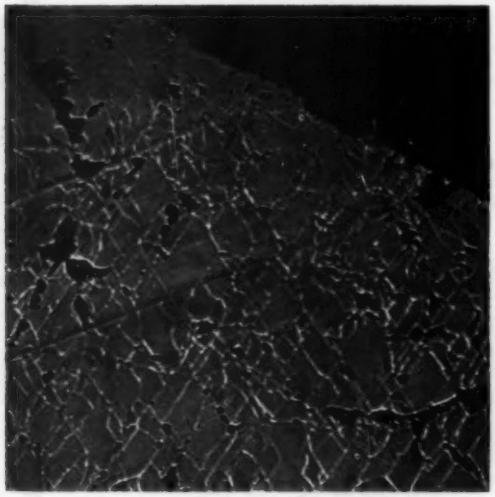


Fig 11. Orientation relative to a crystal edge. (magnif ×210).

appear to be left at a more advanced stage of solution than the irregular networks first discussed, if indeed they are at all related, for it will be recalled that these are four-sided, whilst the others are not. It seems likely that the two types of network have in fact different origins, yet it is most probable that both are connected with the act of re-solution in the final stages of formation of the crystal. These latter regular crystallographically oriented networks strongly suggest the existence on the crystal of some dislocation pattern, for it has already been well established that mild etching can reveal such dislocation patterns. If these boundaries are indeed elevated, then this fact is quite in harmony with some of my earlier etching studies on a polished dodecahedral plane. There I established that etching produced a set of concentric linear hexagonal patterns around the whole outline of the face, and the point of interest is that this pattern was shown to consist of crystallographically oriented *raised* linear ridges. The etching had left these standing proud. Such a mechanism of etch does not appear to be too far removed from the shapes of the rectilinear patterns illustrated here. During the progress of these investigations we have also found a considerable number of surfaces which reveal on them a most unusual distribution of circular disks, indeed, over a thousand such disks have been observed, all told. These are very puzzling and it is intended to describe their characteristics in detail elsewhere. They have been found to overlap some networks.

Trigons are a growth phenomenon

Our earlier laboratory experiments have established that dodecahedral faces are much more readily artificially etched than octahedral faces. Octahedral faces are often found with an excellent degree of planeness, yet on the other hand dodecahedral faces are *almost invariably highly curved*. The common occurrence of a solution network on the dodecahedral face is undoubtedly linked with the marked curvature, and it seems most probable that both these facts together find very strong support for the old view of Fersmann and Goldschmidt that *dodecahedral forms* have suffered marked solution.

It is reiterated that this is *not* believed to be the case for *octahedral* faces, and it is still strongly maintained here that all *trigons* are a *growth* phenomenon and have nothing in common with the oppositely oriented triangular *etch pits* which can be easily induced on octahedral faces. So far, no etching experiments have unambiguously identified trigons with etch pits. On the contrary they are always oppositely oriented. It has been claimed that etching has sometimes produced a large *outline* which is oriented the same way as a trigon. This is true, but it is nothing more than a chain of micro-etch pits preferentially forming around the boundary of a shallow trigon, and, of course, one automatically must get the impression of an etched outline oriented in the direction of the original trigon. To claim

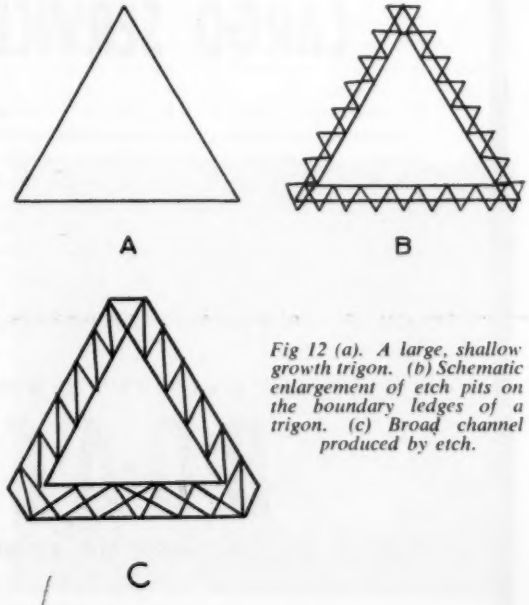


Fig 12 (a). A large, shallow growth trigon. (b) Schematic enlargement of etch pits on the boundary ledges of a trigon. (c) Broad channel produced by etch.

that this is producing an etch pit oriented like a trigon is a complete misinterpretation.

The point is illustrated in Fig 12. In Fig 12a one sees a large but shallow growth trigon. It may easily be so shallow as to miss observation unless precision interferometry is applied. Note that the apex points *upwards*. Now when mild etch takes place the etch pits (which all have their apices pointing *downwards*) preferentially first appear on the ledges which are the boundaries of the trigon. Initially they are very small and not resolved. They are shown enlarged schematically in Fig 12b. We see that the (correctly oriented) etch pits lead to an outline which points in the direction normally taken up by a growth trigon. The separate etch pits may not be seen as such, they may run into each other, and the final result of the etch is to produce a broad channel as in Fig 12c. I have, indeed, seen such effects by etch on typical octahedra with shallow trigons on them, or shallow oriented ring cracks. An example of a trigon so etched is shown in Fig 13.

I repeat that the ubiquitous appearance of trigons on octahedra is definitely a growth effect. Any *natural* etch which is found on octahedral faces is rare, and it is only on infrequent occasions that one finds on the same surface the usual trigons and occasional oppositely oriented etch pits. Most of our knowledge about etch on octahedra has been obtained by artificially etching with oxidants.

Conclusion

This major difference in solution effect between dodecahedra and octahedra is likely to be closely associated with the fact that one mine will produce mainly dodecahedra and the other octahedra. It is suggested that either the temperature, pressure, or concentration conditions which favour the two different forms are probably different, and are such that when dodecahedra appear re-solution is also likely, but that the condition which encourages octahedra does not favour re-solution at all. Of course, a mine is a big region, and one can expect some local variations, but by and large the preponderance of one form in some mines ties up with growth conditions, or solution conditions, as the case may be. What would be of value would be a statistic of the solution markings on dodecahedra secured from different regions. It might well be conjectured that any dodecahedra found in close proximity to a region which was dominantly octahedral would show, on the whole, less tendency to solution than dodecahedra found in a mine which was predominantly dodecahedral. Perhaps some diamond mine geologist will look into this point.

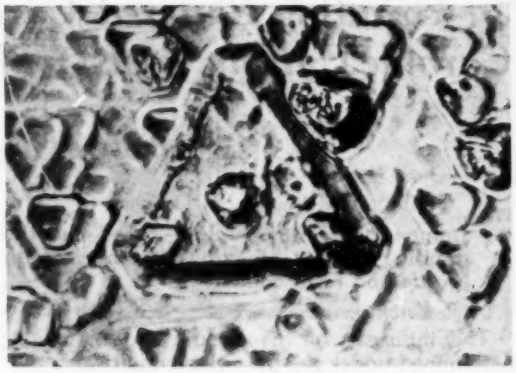


Fig 13. Example of channel effect.

Acknowledgement

Acknowledgements are due to my research student, D. C. Pandeya, who took the pictures illustrating this article.

Coldset Corporation Appointments

The following agents for diamond tools and diamond grinding wheels have been announced by the American Coldset Corporation: Mr. M. E. Clark, North Granby, Connecticut, will cover N. Connecticut, Massachusetts, Maine, New Hampshire, and Vermont; Cummins Machinery Co., 182-184 Courtland St., N.E. Atlanta, Georgia, for Georgia; Mr. W. E. Miller, 11 Orchard Lane, Levittown, Pennsylvania, for E. Pennsylvania and S. New Jersey; Mr. E. L. Brown, 4245 Morris Ave., Birmingham 12, Alabama, for N. Alabama; and Haines Tool Co., 6536 Carnegie Ave., Cleveland 13, Ohio, for N. Ohio.

Brno International Trade Fair Sept 6-20, 1959

An International Trade Fair is to be held at Brno, Czechoslovakia, from Sept 6 to 20, 1959. It is not yet clear, from information available, whether the Czechoslovak diamond tool industry will be represented at the Fair, but the following allied industries are already scheduled to appear: earth drilling equipment, machine tools, powder metallurgy, ceramic machining equipment, metal surface finishing equipment, optical equipment, precision tools and gauges, electro-erosion equipment, and abrasives.

Export of Unmounted Diamonds

The provision permitting the export by registered letter post, insured box post, or air freight, of unmounted, cut, and polished diamonds to any destination, or by insured parcel post to territories scheduled under the Exchange Control Act, 1947, is extended to include all unmounted diamonds with effect from December 1st, 1958.

Grinding Sintered Carbide, Especially Sintered Carbide Cutting Tools, with Diamond Grinding Wheels

by

G. Pahlitzsch and G. Rafflenbeul

Continued from p 234 December

4. Influence of the grinding speed on the grinding results of grinding wheels with bronze and resin bonds

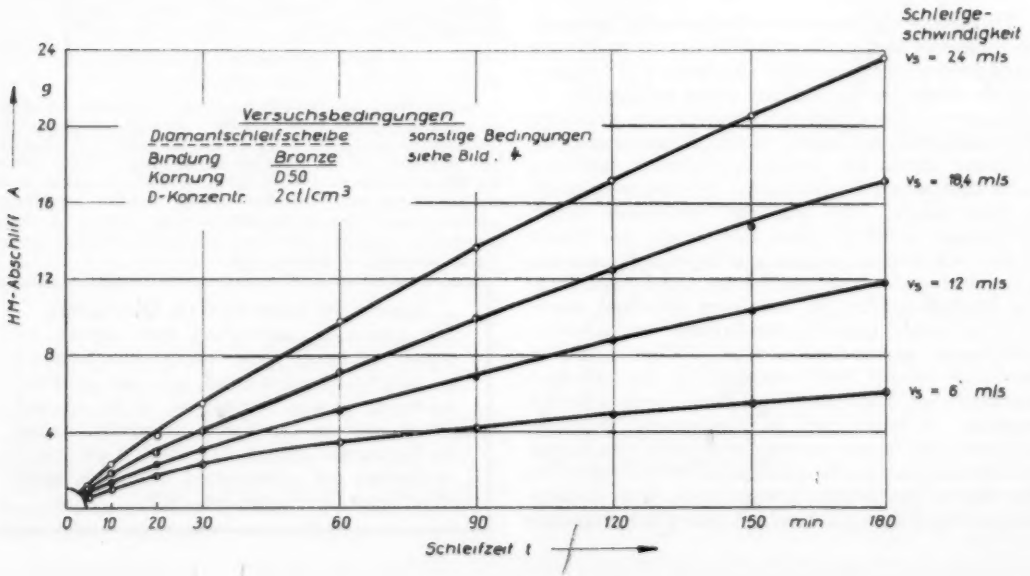
4.1 *Research conditions*

The influence of the grinding speed v_s was determined under the following conditions :

Grinding speed v_s :	~6, 12, 18 and 24 m sec
Number of spindle revolutions n_s:	~ 1000: 2000: 3000, and 4000 rpm
Pressure P:	800 g
Grinding surface F:	max 12.5 × 7 mm min 10.5 × 7 mm
Average surface pressure p:	10 g/sq mm
Movement of workpiece at right angle to the direction of grinding:	
frequency z	60 min^{-1}
amplitude w	4.5 mm
Diamond grinding wheels:	
Bond	Bronze (BZ) Resin (K)
Mesh size	D 80 (40 to 60 micron)
Concentration	2 ct/cub cm
Type of sintered carbide:	S1
Specific weight of carbide:	10.2 ± 0.2 g/cub cm
Front rake of carbide plate β:	90°
Cross section of carbide plate:	~ 13 × 7 mm
Coolant:	EWUSOL [4]
Quantity of coolant:	300 cub cm/min.

In the determination of the force necessary to provide a certain surface pressure, the measurements of the diamond grinding wheel and of the cross section of the sintered carbide plate, their

Fig 6A. Sintered carbide abrasion A with different grinding speeds in relation to the grinding time (bronze bond).
Translation: *HM-Abschliff A = sintered carbide abrasion A; Versuchsbedingungen = conditions of experiment; Diamantschleifscheibe = diamond grinding wheel; Bindung: Bronze = bond: bronze; Koernung: D 50 = mesh size: D 50; D-Konzentr.: 2 ct/cm³ = diamond concentration: 2 ct/cub cm; sonstige Bedingungen siehe Bild: 4 = for other conditions see Fig 4; Schleifzeit t = grinding time t; Schleifgeschwindigkeit v_s etc = grinding speed v_s etc.*



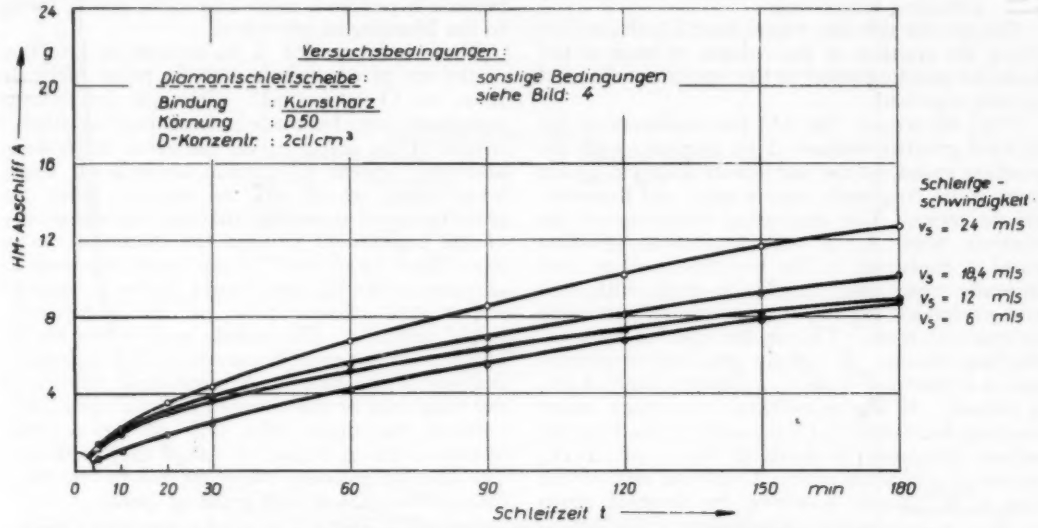


Fig 6B. Sintered carbide abrasion A with different grinding speeds in relation to the grinding time (resin bond).
Translation: *HM-Abschliff A = sintered carbide abrasion A; Versuchsbedingungen: = conditions of experiment; Diamantschleifscheibe = diamond grinding wheel; Bindung: Kunstharz = bond: resin; Koernung: D50 = mesh size: D50; D-Konzentr.: 2 ct/cm³ = diamond concentration: 2 ct/cub cm; sonstige Bedingungen siehe Bild: 4 = for other conditions see Fig 4; Schleifzeit t = grinding time t; Schleifgeschwindigkeit: v_6 etc = grinding speed v_s etc.*

reciprocal overlap, the frequency and the amplitude of the workpiece oscillation, as well as the sine curve of the speed of the latter, were considered.

4.2 *Results of experiments*

4.21 Abrasion of sintered carbide

In Fig 6 and 7 the sintered carbide abrasion A and the sintered carbide per unit of time A' for BZ and K wheels for various grinding speeds are plotted over the grinding time. It is recognized that at the beginning of the grinding, *ie* when the wheel is sharp, the graphs for the abrasion A (Fig 6) have a steeper upward trend than after longer grinding time, in the course of which the grinding wheels are blunted. This tendency is far clearer in the representation of the abrasion/time unit A' in Fig 7.

With BZ wheels (Fig 7A), the character of the abrasion graphs for different grinding speeds is more or less uniform. On the other hand, however, it appears that the curves in the graph for higher grinding speeds are less pronounced, and the 'relative' adhesion of the BZ wheel, therefore, is preserved longer with increasing load on the wheel. From Fig 8A it is evident that the abrasion in the region examined rises almost proportionately with the grinding speed. It assumes, however, a slightly progressive tendency with speeds between 18 and 25 m/sec, which supports Ripple's[5] experiments. He examined the sintered carbide abrasion for a metal-bonded diamond grinding wheel with grinding speeds between 20 and 70 m/second.

With K wheels (Fig 7B) the facts are not so well-defined. The abrasion per time unit A' decreases rapidly, and the values given for the different grinding speeds overlap. This phenomenon arises from the fact that the K bond offers less resistance to the diamond grains which are exposed after truing, and which are therefore the most heavily worked, than does the BZ bond. Furthermore, the K wheel is sensitive to changes in the form of the film of coolant between grinding wheel and workpiece. An increase in the grinding speed causes only a relatively small increase in the abrasion (Fig 8B).

Although the abrasion shows a progressive tendency, a fourfold increase in grinding speed in the region under examination causes a rise in abrasion of only about 60 %.

A comparison of the results obtained with the BZ wheel and the K wheel (Fig 8) shows that the abrasion obtained with the K wheel is between 143% and 54% of that obtained with the BZ wheel, and is smaller by about 30% on average. As the sintered carbide abrasion is not the only important factor in estimating the grinding process, the recommended grinding speeds are considered in the following sections.

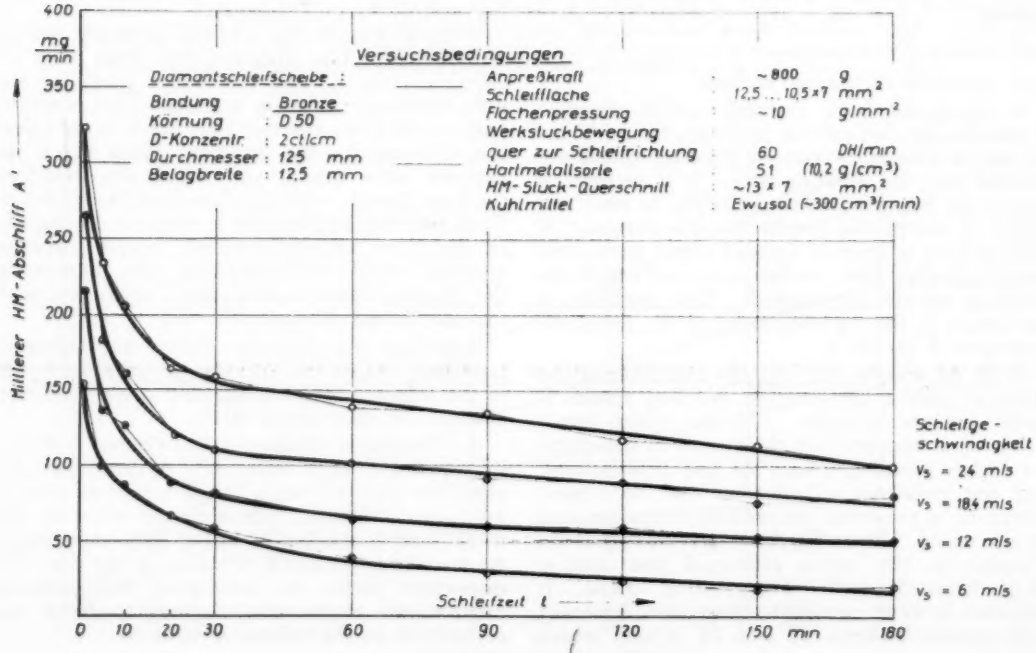
4.22 Grinding wheel wear

The specific grinding wheel wear S (cub cm/cub cm) is the relation of the volume of wear of the diamond grinding wheel to the amount of sintered carbide removed.

With BZ wheels (Fig 8A) the thickness of the abraded grinding surface ΔH_s increases with the grinding speed, as the individual diamond grains come more frequently into action. and therefore abrade more. The decreasing tendency of the absolute wear ΔH_s with increasing grinding speed is explained by the fact that a sharp tool generally wears away quickly to begin with, and with prolonged use sets up a continually growing resistance to wear. This applies also for diamond grinding wheels. In certain grinding conditions and in a specified time, t_1, a definite wear, ΔH_{s1} is caused. If the conditions are made more exacting, for example if the grinding speed (or the surface pressure) is doubled, the wear ΔH_{s2} occurs in a shorter time. Until the end of the time t_1 it cannot, however, be doubled again because it proceeds more and more slowly owing to the blunting of the wheel.

Thus the curve for ΔH_s appears as a section of the arc of a parabola with its point of origin at v_s = O m/second. Although no definite statements can be made concerning the further course of the graph curve, the value ΔH_s does, however, appear to extend towards an upper limit value, which will be reached when the grinding speed is so high that the stipulated time of the experiment permits the diamonds to be worn down to the level of the bond, as a wear or abrasion of the BZ bond could not be ascertained within the chosen time of the experiment, *ie* 180 minutes. The metals held in the bronze bond could not even be ascertained by a chemical analysis of the swarf. A volumetric plotting of the wear and of the sintered carbide abrasion is omitted, for these differ only in the constant factors of the ΔH_s and A values they represent. The specific grinding wheel wear S has its most favourable value at high grinding speeds.

Fig 7A. *Average sintered carbide abrasion A' with different grinding speeds in relation to the grinding time (bronze bond).* Translation: *Mittlerer HM-Abschliff A' = average sintered carbide abrasion A'; Versuchsbedingungen = conditions of experiment; Diamantschleifscheibe = diamond grinding wheel; Bindung: Bronze = bond: bronze; Koernung: D50 = mesh size: D 50; Durchmesser: 125 mm = diameter: 125 mm; Belagbreite: 12.5 mm = width of grinding surface: 12.5 mm; Anpresskraft: ~ 800 g = pressure force: ~ 800 g; Schleifflaeche: 12.5 . . . 10.5 x 7 mm² = grinding surface: 12.5 to 10.5 x 7 sq mm; Flaechenpressung: ~ 10 g/mm² = surface pressure: ~ 10 g/sq mm; Werkstueckbewegung quer zur Schleifrichtung: 60 DH/min = movement of workpiece at right angles to the direction of grinding: 60 strokes/minute; Hartmetallsorte: S1 (10.2 g/cm³) = type of sintered carbide: S1 (10.2 g/cub cm); HM-Stueck-Querschnitt: ~ 13 x 7 mm² = cross section of sintered carbide piece: ~ 13 x 7 sq mm; Kuehlmittel: Ewusol (~ 300 cm³/min) = coolant: Ewusol, etc; Schleifzeit t = grinding time t; Schleifgeschwindigkeit v_s etc = grinding speed v_s etc.*



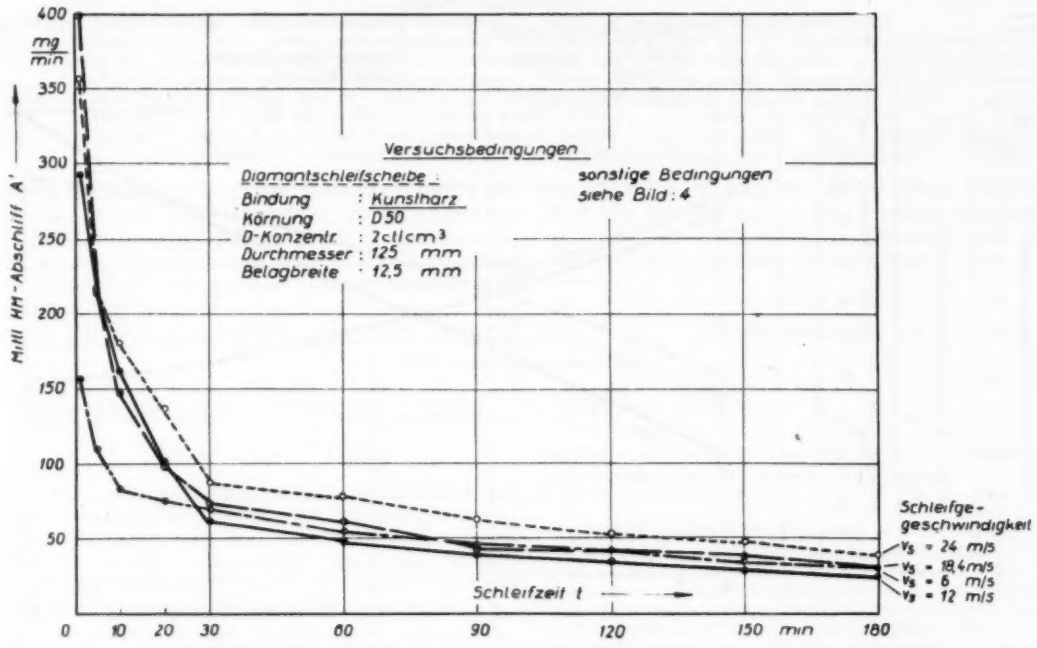


Fig 7B. *Average sintered carbide abrasion A' with different grinding speeds in relation to the grinding time (resin bond).* Translation: *Mittl. HM-Abschliff A' = average sintered carbide abrasion A'; Versuchsbedingungen: = conditions of experiment; Diamantschleifscheibe = diamond grinding wheel; Bindung: Kunstharz = bond: resin; Koernung: D50 = mesh size: D50; D-Konzentr: 2 ct/cm³ = diamond concentration: 2 ct/cub cm; Durchmesser: 125 mm = diameter: 125 mm; Belagbreite: 12.5 mm = width of grinding surface: 12.5 mm; sonstige Bedingungen siehe Bild: 4 = for other conditions see Fig 4; Schleifzeit t = grinding time t; Schleifgeschwindigkeit v_s = grinding speed v_s etc.*

For K wheels (Fig 8B) the opposite is true of what was stated for the BZ wheels as regards the specific wear. The absolute wear ΔH_s rises steeply with the grinding speed (note scale opposite Fig 8A), as the relatively soft K bond cannot provide the necessary resistance to the increased stress. The sintered carbide abrasion, on the other hand becomes, only slightly greater, as a result of which the specific wear S necessarily increases with the grinding speed.

Both the specific and the absolute wear of the K wheel, owing to the different hardnesses of the bonds, are greater than those of the BZ wheel, which is to be noted particularly with high grinding speeds. The ΔH_s values do tend to increase with both grinding wheels, but for BZ and K wheels a contrary behaviour of specific wear is noted (see scale). If the value for the BZ wheels is set at 100%, then the K wheel has an absolute grinding wheel wear about 80 to

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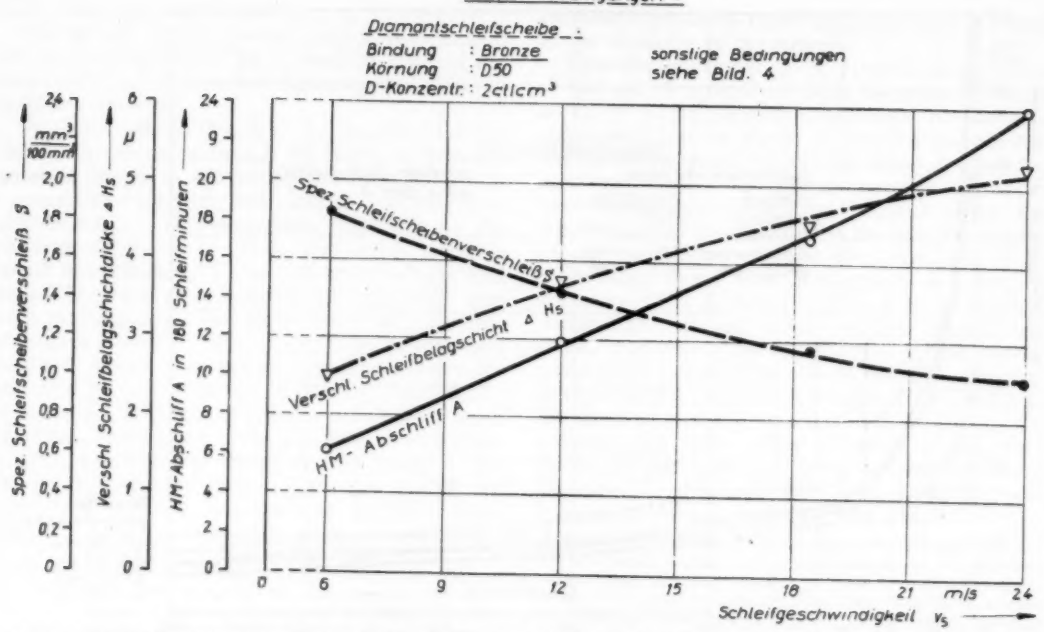

Fig 8B. *Sintered carbide abrasion and grinding wheel wear in relation to the grinding speed (resin bond).*
Translation: *Spez Schleifscheibenverschleiss S = specific grinding wheel wear S; Verschl. Schleifbelagschichtdicke Δ H_s = thickness of abraded grinding layer Δ H_s; HM-Abschliff A in 180 Schleifminuten = sintered carbide abrasion A in 180 minutes' grinding: Versuchsbedingungen = conditions of experiment; Diamantschleifscheibe = diamond grinding wheel; Bindung: Kunstharz = bond: resin; Koernung: D50 = mesh size: D50; D-Konzentr: 2 ct/cm³ = diamond concentration: 2 ct/cub cm; sonstige Bedingungen: siehe Bild 4 = for other conditions see Fig 4; HM-Abschliff A = sintered carbide abrasion A; Cerschl. Schleifbelagschicht Δ H_s = abraded grinding layer Δ H_s; Spez Schleifscheibenverschleiss S = specific grinding wheel wear; Schleifgeschwindigkeit v_s = grinding speed v_s.*

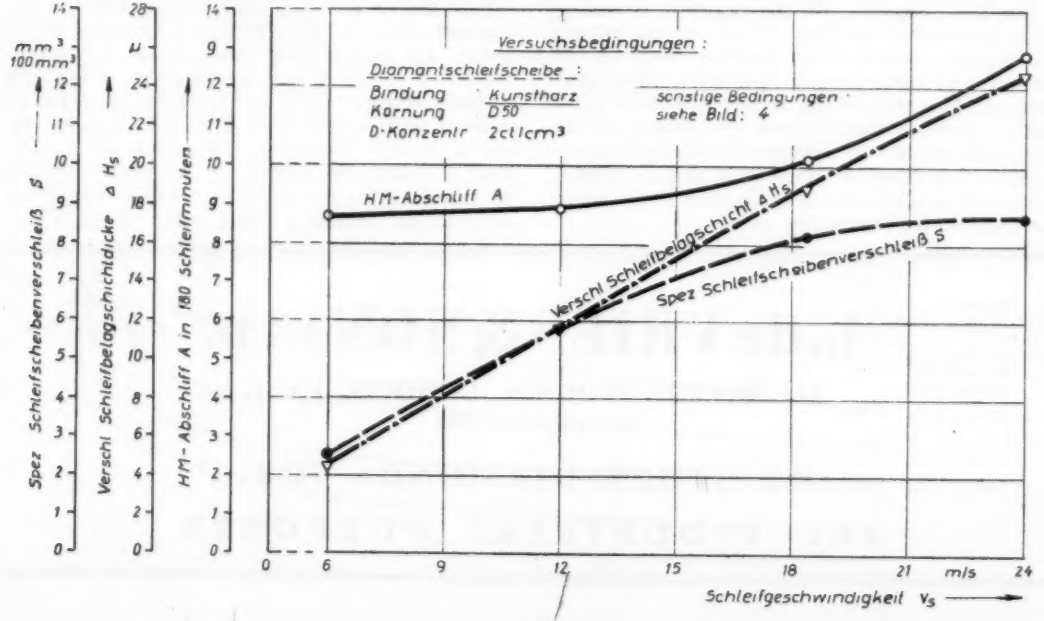

Fig 8A. Sintered carbide abrasion and grinding wheel wear in relation to the grinding speed (bronze bond).
Translation: *Spez. Schleifscheibenverschleiss S = specific grinding wheel wear S; Verschl. Schleifbelagschichtdicke Δ H_s = thickness of abraded grinding layer Δ H_s; HM-Abschliff A in* 180 *Schleifminuten = sintered carbide abrasion A in* 180 *minutes of grinding; Versuchsbedingungen: = conditions of experiment; Diamantschleifscheibe = diamond grinding wheel; Bindung: Bronze = bond: bronze; Koernung D50 = mesh size D50; D-Konzentr.: 2 ct/cm³ = diamond concentration: 2 ct/cub cm; sonstige Bedingungen siehe Bild: 4 = for further conditions see Fig 4; Spez. Schleifscheibenverschleiss S = specific grinding wheel wear S; Verschl Schleifbelagschicht Δ H_s = abraded grinding layer Δ H_s; HM-Abschliff A = sintered carbide abrasion A; Schleifgeschwindigkeit v_s = grinding speed v_s.*

365% greater, and a specific grinding wheel wear about 26 to 760% greater. It is therefore important to apply higher grinding speeds with BZ wheels and lower ones with K wheels, in order to grind down the greatest possible quantity of sintered carbide with a certain volume of grinding layer. In order to calculate the pure diamond consumption in carats/cub cm of sintered carbide from the specific wear S, the S values should be multiplied by 0.02, which is obtained from the diamond concentration of the wheel.

Note.—All references will appear at end of article.

To be continued.

Sales Increased by 'Pressure Testing' Diamond Abrasives

A new process for the manufacture of diamond abrasives has been developed by the Diamond Tool Research Co. Inc., of New York. Sales have increased substantially since the treated diamonds were introduced to customers, and the Research Company believes that the great economy provided by their product will increase the use of diamond abrasives.

'Pressure testing' process

Diamond abrasives in their natural form consist of several shapes : in the pressure testing process the slivers, flats, and pieces with severe internal stresses are subjected to a pressure that reduces them to blocky sharp-edged grains. Round-edges—sources of frictional heat—are eliminated, and the fast cutting blocky shapes cut smoothly and without undue heat. The grits produced in this way are used in resin- and metal-bonded wheels and mining bits ; they are also available in graded mesh sizes and as compounds. Tests with these products show increased life and greater cutting efficiency.

Further tests ahead

Additional tests are already in progress, but earlier results have shown definite advantages over conventionally prepared abrasives.

John F. Hoffmeister Appointed by Longyear Co

The E. J. Longyear Co., 76 South Eighth St., Minneapolis, Minnesota, have announced the appointment of John F. Hoffmeister as Chief Engineer. He will direct all the company's mechanical engineering activities in the diamond core drill manufacturing and diamond drilling fields.

'Auto-Twin' Combination Edger

Autoflow Engineering Limited, of Rugby, recently introduced the 'Auto-Twin' combination edger for the optical industry. Features include a Diagrit diamond wheel, automatic cycle time, and a special lens alignment jig. Full details of the machine can be had from the company's Rugby office.

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Correction

Industrial Diamond Review 1958 Vol 18 (216) p 206 (Nov); left-hand col, line 9: for '2 micro-in.' read '0.2 micro-in.'.

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INDUSTRIAL DIAMOND ABSTRACTS

Industrial Diamond Information Bureau,
2 Charterhouse Street, London, EC 1.
Telephone : FLEet Street 1577

1959 Volume 16
JANUARY

New Classification System Adopted

Copies available to readers if sufficient requests received

Introduction

In order to aid the retrieval of information from our abstract files, a new classification system has been adopted. It is a ' faceted ' classification with an alphabetical breakdown which permits a greater degree of detail and higher flexibility than the present system. Each facet is comprised of a group of similar concepts, *eg* similar materials such as carbides and metals, and it is the relation of the facets, and not the order within a facet, that is of importance. In order to separate information on diamonds from that on other materials, the diamond facets have been grouped in ' main ' facets *D* to *N*. Pre-facets *A* to *C* and post-facets *P* to *W* relate to other materials. There is also an auxiliary section with numerical breakdown for non-technical processes, general information, and geographical locations.

In classifying under this system the first step is to decide the logical order of the concepts in any given abstract, and then to code them appropriately. The usual type of sequence is object or material worked, process employed, tool used, properties, etc, though exceptions to this will be shown here. In order to illustrate this five examples are given below.

Examples

(1) In an abstract on the ultrasonic drilling of industrial diamonds for drawing dies, the order is industrial diamonds—ultrasonic drilling—drawing dies. Industrial diamonds are *Fc*, ultrasonic drilling is *Hqf*, and diamond drawing dies are *Nkb*, giving a final code of *Fc Hqf Nkb*.

(2) If an abstract relates to resin-bonded grinding wheels for grinding sintered carbide milling cutters, the order is milling cutters — sintered carbide — grinding — grinding wheel — resin bond, which gives a code of *Alc Bkc Chc Pe Urb*.

(3) If it is necessary to break the alphabetical order due to the logic of the system (*eg* a process must precede the tool used in it) a colon is inserted. Dressing appears in secondary technical processes, facet *Q*, while dressing sticks appears in tools, facet *P*, so the order for an abstract on the dressing of diamond grinding wheels with dressing sticks of silicon carbide is diamond grinding wheels — dressing :dressing sticks — silicon carbide, which gives a code of *Nv Qec:Pjb Rgc*.

(4) An asterisk is used to denote comparison. The classification for diamond engraving tools compared to steel engraving tools is *Nc*Pp Sw*.

(5) If an abstract contains separate sets of concepts, then each must be classified separately, the coding being separated by an oblique stroke. Hence in an abstract on cutting tools for machining steel and brass, the concepts are steel — machining — cutting tools, and brass — machining — cutting tools, which is coded as *Bfd Ceq Pd/Bfxg Ceq Pd*.

Copies of the filing scheme will be made available to the users of the Information Bureau Services if a sufficient number of requests is received.
F

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DIAMOND MINING AND INDUSTRY

The present results of diamond digging in the Yakutsk district. Die bisherigen Ergebnisse der Diamantschuerfung im Gebiet Jakutsk

Anon. *Dtsch Goldschmiede Ztg* 1958 Vol 56 (11) pp 657-658 (Nov) (In German)

'*Woprossy Ekonomiki*' writes that large quantities of diamond are present in the Western region of the Yakutia district. There are six distinguishable belts in which diamonds lie, and they are in large enough quantities for a considerable diamond industry to be set up there. Crystals vary from very small to 3-5 carats, and diamonds of 10-11 ct occur. The largest so far found is of 32.5 carats. The majority are colourless and transparent. In ultraviolet light they give a bluish or yellowy-green light. The specific gravity varies between 3.52 and 3.56. A negligible proportion is suitable for jewellers' purposes.

The Malo-Botuobinsk belt has economic advantages for the establishment of an industry as regards transport and fuel, although the Daldyno-Alakitsk belt produces better and more numerous diamonds but has the disadvantage of being within the Arctic Circle in the tundra area. The Soedne-Marchinsk belt is also well-situated for industry, but, in summing up '*Woprossy Ekonomiki*' considers Malo-Botuobinsk to be the most favourable area, followed by Daldyno-Alakitia.

A *Eb Fb.332*

Mécanélec Exhibition, Paris. II

Anon. *Machinery* (London) 1958 Vol 93 (2404) pp 1351-1355 (Dec 10)

(Cont). Milling, boring, grinding, and spark erosion machines are described, among which are the Malicet and Blin grinding machines.

Type R12-58, suitable for finishing holes from 0.4 to 3¼ in. diameter, has a sizing process which allows the process to be done either by the plug gauge or the indirect, diamond, method, the selection being made by turning a knob. After both the roughing and finishing stages of the cycle, the wheel is retracted from the cut before it is withdrawn axially, to prevent marking of the workpiece bore. Type RC 1 has profile truing devices for the grinding and control wheel peripheries, as well as providing for truing the side of the grinding wheel when handling shouldered components, and for adjusting the wheel axially to compensate the resulting reduction in width. The same firm also makes testing machines for Rockwell and Brinell hardness values, which are shown. 8 illustr.

A *Chc Pr Wbbg/Abm Cg Nj Psf/Wgh*

Treasures that do not belong to them [Tanganyika diamond mining]

Anon. *Zmina* 1958 (6) p 22 (June); *Library of Congress Mthly Index Russ Access* 1958 Vol 11 (7) p 22[illegible]5 (Oct) (Original in Russian)

X *Hd.364*

Russians 'find diamonds in their car tyres'

C. Reid. *Daily Telegraph* 1958 (32241) p 13 (Dec 11)

A Siberian diamond pipe so rich that diamonds are picked up in car tyres is reported by the *Diamond Fields Advertiser*. A very general picture of the Kimberley diamond mining industry is given.

W *Ebc.332/Hd.361*

Diamonds

Anon. *Min Trade Notes* 1958 Vol 47 (5) pp 30-31 (Nov)

Production figures for Angola and Tanganyika for 1956 and 1957 are shown. The results of agreements relating to Williamson Diamonds Ltd are summarized. 1 table.

W *F.13.364/F.13.3676*

Report on the (Sierra Leone) Mines Department 1956

Anon. *IMM Abstr* 1958 Vol 8 (6) p 381 (Aug-Sep)

Book, Government Printer, Freetown. 1958, 15 pp. Price: 1s 6d.

Production of chromite, diamonds, Fe ore, Au, and Ti minerals is reviewed. [Book not in library of Ind Diamond Inf Bur].

W *Bc.13.3672/F.13.3672*

Diamond mining in the Union of South Africa. Die Diamantenerzeugung in der Suedafrikanischen Union

Anon. *Dtsch Goldschmiede Ztg* 1958 Vol 56 (11) p 657 (Nov) (In German)

Facts and figures are supplied concerning the development of diamond mining from the early digging at Jagersfontein and Dutoitspan in 1870 to the selling system through the Central Selling Organisation in 1956.

A *Hb.28.361*

Diamonds. Prospecting in French West Africa. Diamanti. Richerche nell'Africa occidentale francese

Anon. *Annales des Mines* 1958 (Aug); *Industria Mineraria* 1958 Vol 9 Ser II (10) p 641 (Oct) (In Italian, original in French)

When prospecting for diamonds in the Kenieba region, experience gained by Soviet prospectors has been used, though with poor results.

M *Eb.12.3662*

Reports from the geological surveys

Anon. *Overseas Geology & Mineral Resources* 1958 Vol 7 (2) pp 166-190

The alleged occurrence of diamonds in the Embu area of Kenya has been investigated without result. Diamond prospecting projects in the Mazaruni-Kurupung-Meamu river basins have recently been examined.

W *Eb.12.369:2232*

Quality and value of Indian diamonds produced in 1951-1955

B. K. Breshenkov. *Biul TSIIN tsvet met* 1957 (17) pp 30-32; *Library of Congress Mthly Index Russ Access* 1958 Vol 11 (7) p 2145 (Oct) (Original in Russian)

X *F G.371*

Twelve thousand diamond peaks

N. Khokhlov. *Vokrug sveta* 1958 (7) pp 12-16 (July); *Library of Congress Mthly Index Russ Access* 1958 Vol 11 (7) p 2111 (Oct) (Original in Russian)

X *Eb.33*

Kimberlite bodies in the valleys of Omonoos River, Olenek region

M. A. Kritoyarskii. *Zap Vses Mineralog Obshch* 1958 Vol 87 pp 166-180; *Chem Abstr* 1958 Vol 52 (18) col 15362 (Sep 25) (Original in Russian)

Examination of the 36 kimberlite out crops; probably extending in a north-eastern direction, discovered in wide regions of the fluviatile systems of the Olenek, Muna, and Daldyn rivers. Diamonds were found not only as an accessory mineral in the kimberlites, but also in placer deposits.

A *Ebc.332:Vwd*

Diamonds: mass production of synthetic diamonds in 1958. Entro il 1958 la produzione in masse di diamanti artificiali

Anon. *Quot USIS* 1958 (May 2); *Industria Mineraria* 1958 Vol 9 Ser II (7) p 428 (July) (In Italian)

GEC announce that they hope to start mass production of synthetic diamonds before the end of the year.

M *Fh Ha.13*

PHYSICAL, CHEMICAL, & MECHANICAL PROPERTIES OF DIAMOND AND OTHER HARD MATERIALS

Synthetic gemstones. II

R. Webster. *Gemmologist* 1958 Vol 27 (325) pp 146-152 (Aug)

(Cont). The crucible method used by Verneuil for producing synthetic ruby is described, in which the boule forms a 'candle' of fine-clay under great pressure in a furnace. (To be cont). 8 illustr.

A *Bbeb Ctb*

Emeralds from Sandawana

E. J. Guebelin. *Journ Gemmol* 1958 Vol 6 (8) pp 340-354 (Oct)

The emeralds discovered in 1957 at Sandawana in the Belingwe district of Southern Rhodesia are described under the following headings: (*i*) occurrence; (*ii*) appearance; (*iii*) chemical composition; (*iv*) physical properties; and (*v*) internal characteristics. 7 illustr, 6 ref, 3 tables. *W* *Bbjb.363*

Pattern of field emission of crystals of tungsten and molybdenum carbides

A. P. Komar, Yu. N. Talanin. *Izvest Akad Nauk SSSR* 1958 Vol 22 (5) p 580; *DSIR Transl Contents Lists Russ Period* 1958 (116) p 60 (Nov) (Original in Russian)

X *Bk Ue*

Research on luminescence phenomena and their application in the Soviet Union

V. L. Levshin. *Uspekhi Fiz Nauk* 1958 Vol 64 (1) p 55; *DSIR Transl Contents Lists Russ Period* 1958 (116) p 183 (Nov) (Original in Russian)

X *Ukn V.33*

Carbon, graphite and diamond

H. J. Logie. *Diamant* 1958 Vol 1 (6) pp 7-10 (Oct) (In English, Flemish, and French)

A general crystallographic comparison of carbon, graphite, and diamond.

W *Bhb Ub*F Ub*

Colour and coloration of diamond

F. A. Raal. *Diamant* 1958 Vol 1 (6) pp 12-14 (Oct) (In English, Flemish, and French)

A short survey of factors influencing the colour of diamond. 2 illustr, 4 ref. *W* *F Ukb*

Meteorites, satellites, and ceramics

J. S. Rinehart. *Am Ceram Soc Bull* 1958 Vol 37 (11) pp 461-467 (Nov)

Abr of paper to General Session of 60th Annual Mtg of the Am Ceram Soc, Pittsburgh, Pa, Apr 28, 1958.

It is briefly mentioned that diamonds are occasionally found as inclusions in meteorites. From these, information was gained which aided the development of synthetic diamonds. 14 illustr, 2 tables.

W *Ha|Hb*

Estimation of weight of faceted coloured stones by measurement. Gewichtsbestimmung von facettierten Farbsteinen durch Messung

K. Schlossmacher. *Gold & Silber* 1958 Vol 11 (11) pp 13-14 (Nov) (In German)

A new system is described for the weight calculation of cut stones by measurement of the length and breadth of the girdle and the thickness. The formulae applicable in different cases are given.

A *Kb:Hj|Tg Ve*

The manufacture of synthetic diamonds. Herstellung kuenstlicher Diamanten

Anon. *Umschau* 1958 Vol 58 (22) p 691 (Nov 15) (In German)

The GEC, USA Diamond Co, and Swedish GEC (ASEA), have all been working successfully to produce diamonds artificially and have applied for patents. The material used is graphite. Stones range from 0.5 to 1.2 mm, and are produced at temperatures between 1,300 and 3,000 deg C, at pressures of up to 100,000 atmospheres. The most advanced method seems to be that of ASEA, where a pressure of 100,000 atm is produced in a volume of 500 cub cm, and a temperature of 4,000 deg C maintained for some time. The autoclave materials best suited to the conditions are carbide mixtures of tungsten, tantalum, and titanium. The experiments in high pressure and high temperature reactions should be useful in other fields of industry.

A *Fh Ha*

Synthetic gems

L. A. Thomas. *Research* 1958 Vol 11 (12) pp 466-471 (Dec)

Details of the production and properties of synthetic corundum, synthetic quartz, and synthetic garnet are given. On synthetic diamond, the article is restricted by lack of technical details; it confines itself to a discussion of the earlier work on synthetic diamond which preceded the successes of the Gen Electr Co and, independently, of ASEA in Sweden. The structural analogy between diamond and Borazon is shown by an illustration of their molecular structure. 7 illustr, 1 table. *W* *Bbb Cql U|Fh Ha|Fh*Re*

Etching and orientation measurements of diamond type crystals by means of light figures

G. A. Wolff, J. M. Wilbur, J. C. Clark. *Z Elektrochem* 1957 Vol 61 (1) pp 101-106; *Techn Wiss Ber Osram* 1958 Vol 31 (1/2) p 8 (Oct 15) (Original in German)

In the method used, parallel light is reflected from the crystal surface being examined, on to a screen. From such a projection of etch figures the orientation of crystals can be calculated to within a few minutes of accuracy. *A* *Bd Ubc V*

New semiconducting compounds

V. P. Zhuze, V. M. Sergeeva, E. L. Shtrum. *Journ Techn Phys* (Moscow) 1958 Vol 28 (2) pp 233-236; *Sci Abstr* 1958 Vol 61A (728) p 465 (Aug); *BSIRA Bull* 1958 Vol 13 (11) p 310 (Nov) (Original in Russian)

Electrical conductivity, thermoelectric power, Hall effect, crystal structure, melting point, and microhardness were studied for various new semiconducting compounds, in particular $AgFeSe_2$ and $AgFeTe_2$.

X *Bde Ub|Bde Ud|Bde Uec|Bde Unhd*

Mechanical behaviour of microstrystals

W. W. Webb, W. D. Forgeng. *Acta Metall* 1958 Vol 6 (7) pp 462-469 (July)

Bend tests were carried out on some small crystals chemically extracted from two-phase alloys, and on some whiskers and other small crystals grown from liquid or vapour phases. One of the crystals studied was sapphire ($\alpha = Al_2O_3$). The results are discussed in detail, and it is concluded that although metal whiskers are unique because of the absence of edge dislocations, the occurrence of other crystals with nearly theoretical strength is not unusual. There is some evidence that dislocations have little effect on the mechanical properties of hard or brittle microcrystals, and it appears that a distinction should be made between those crystals eventually failing by brittle fracture and those that fail by plastic deformation. 3 illustr, 27 ref, 2 tables. *A* *Bd Unle*

New facts about synthetic diamond. Neues vom synthetischen Diamanten

Anon. *Dtsch Goldschmiede Ztg* 1958 Vol 56 (11) p 648 (Nov) (In German)

W. Anderson has conducted much experimental research into the nature of synthetic diamond. It has been found that, unlike natural diamond, the synthetic contains nickel and shows unknown interferences under x-ray examinations. Each GEC crystal consists of a basic quantity of 'normal' diamond with a lattice constant of 3.567 AU, in which isolated patches of diamond substance with a lattice constant of 3.54 AU are embedded. In some of the synthetic diamonds a faint luminescence of blue, green, and yellow was noticed in ultraviolet light, and all were found to be magnetic. They are composed of an agglomeration of small and very small crystals, which can easily be split up, and each is found to consist of parallel growths of diamond crystal in which the octahedron prevails. In some cases the cube is also found.

A crystal is shown magnified so that a cleavage line can be seen. The smaller part, which must formerly have been a complete crystal in itself, has grown somewhat faster than the larger part. In another photograph, the skeleton formation is apparent, showing that the growth was 'stormy' and of short duration. A central six-sided formation is visible lying parallel with the octahedron face and slightly higher. This shows that in the crystallization process there was a tendency towards rhombus dodecahedron and cube surfaces, which led to this six-sided limitation of the octahedron surface. This crystal was about 0.3 mm, very large for a synthetic stone. 2 illustr.

A *Fh Ubb*

Effects at very high pressures

Anon. *New Scientist* 1958 Vol 4 (98) p 968 (Oct 2)

The applications of ultra-high pressures are discussed, and it is mentioned that diamond can be synthesised at 100,000 atm at 2,000 deg Centigrade.

W *Ha Vcb*

Harder than hardest

D. E. Spilsbury. *New Scientist* 1958 Vol 4 (100) p 1082 (Oct 16)

Letter to the Editor.

Comments on 'Effects at very high pressures' (above) and asks whether it would be possible under extreme temperatures and pressures, to produce a silicon crystal similar to, but harder than, diamond.

W *Bhc Cql Vcb*

Silicon and diamond

R. H. Bruce. *New Scientist* 1958 Vol 4 (107) pp 1456-1457 (Dec 4)

Letter to the Editor.

In answer to 'Harder than hardest' (above) it is stated that the normal variety of silicon is already the hardest conceivable form, and it possesses only half the hardness of diamond. *W* *Bhc Ubb Unh*

Healing feathers in gemstones. Heilungsrisse in Edelsteinen

Anon. *Gold & Silber* 1958 Vol 11 (11) p 15 (Nov) (In German)

Healing feathers in rubies, sapphires, and emeralds play an important part in testing. In ruby and sapphire they are a sign that they are natural stones. In emerald, however, the feathers are present whether natural or synthetic, but there is a difference in their form. The probable causes of their occurrence and the forms in which they appear are described.

A *Bbd Ub/Bbe Ub/Bbjb Ub*

Industrial diamonds have wide market; reclaim value high

Anon. *Purchasing Week* 1958 Vol 1 (33) pp 12-13 (Aug 18)

Various diamond tools and machining operations are shown. It is suggested that the hardness of diamond makes it brittle and unsuitable for use on ferrous materials. *W* *Ceq Nf*

Diamonds aren't as brittle as one might think

J. Klipper (Clipper Diamond Tool Co Inc). *Purchasing Week* 1958 Vol 1 (44) p 10 (Nov 3)

Letter to the Editor.

Replying to 'Industrial diamonds have wide market; reclaim value high' (above) it is stated that silicon carbide, aluminium oxide, and other hard abrasives are more than 100 times as brittle as diamond. An indenting diamond with a 0.003 in. radius, hardness testing under a load of 5 kg, withstands a pressure of 1,200,000 lb/sq inch. Correctly oriented diamonds have provided 'amazing' results when machining hardened and stainless steel.

W *Fc Unl/Bfd Ceq Nf*

DIAMOND, ETC, IN INSTRUMENTS

The K-103 multiple-spindle machine for drilling small size holes in ruby watch stones

G. N. Baltin. *Izobr i rats* 1958 Vol 3 (4) pp 16-17 (Apr); *Library of Congress Mthly Index Russ Access* 1958 Vol 11 (7) p 2099 (Oct) (Original in Russian)

X *Bbe Cfb Pr Tc*

Dimensional and qualitative standards for watch jewels. Les normes dimensionnelles et de qualité pour les pierres d'horlogerie

A. Donat. *Prod Horl fr* 1958 (2) pp 1-14; *Annales Franc de Chron* 1958 Vol 28 p 132 (3rd quarter) (In French)

The new standards of Cetehor, formed in February 1958, are put forward. They concern size and quality of all types of gems used in watches and clocks.

A *Tc.255*

Swiss P 331,447 (July 20, 1955) **W. Zaugg**

Hole finishing machine for watch jewels. Grandiermaschine fuer Uhrensteine

In known machines the finishing wire is reciprocated by a crank mechanism so that the speed of the wire is not uniform inside all jewels arranged in a long row. The number of stones to be scrapped is, therefore, usually rather high. On the other hand reciprocation of the carriage carrying the finishing wires with constant speed means sudden reversal of direction which may break the fine wires. This danger can be eliminated by the interposition of friction clutches for reversing the driving gear so that it becomes possible to change the direction without a jerk. The clutches may be of an electromagnetic type controlled by relays through a photo-electric cell dependent on the position of the carriage. (11 claims, 4 illustr).

J *Chmg Pr Ps Tc*

INDUSTRIAL DIAMOND TRADE NAMES INDEX

Readers are reminded that the forms distributed with the December issue of *Industrial Diamond Abstracts* should be returned not later than February 28th. If further forms are required, they can be obtained from: Industrial Diamond Information Bureau, 2 Charterhouse Street, London EC 1.

HARDNESS AND WEAR TESTING

Experiences in low load hardness testing

P. Grodzinski. *Microtecnic* 1958 Vol 12 (4) pp 197-205 (Aug)

When work on the microhardness testing of hard materials, such as sintered carbide, silicon carbide, aluminium oxide, and diamond was started about 8 years ago, a Bergsman micro-hardness tester (up to 200 g load) was fitted to the available Vickers projection microscope using a Vickers diamond. Subsequently a stronger Bergsman type hardness tester for loads up to 3,000 g was devised; this was provided with automatic control. The limitations of this hardness tester were later on overcome by an optical system arranged at an angle to the mechanical system, a sensitive damping device controlling the indenting process. In order to perform tests at various loads to find the real hardness properties of materials, the so-called Meyer analysis was used. Considerations with regard to the low-load range led to a proposal to denne nardness not as a load divided by unrecovered indentation area, but to express it as the load which causes a standard deformation in the material. This led to the design of a low-load hardness tester in which the load is increased continuously, measuring at the same time the depth of indentation. By combining a mechanical loading device with pneumatic measurement of depth of indentation, it was possible to record the load/depth of indentation characteristic in a diagram. A preload can be applied. Besides the load/depth curves, time/depth curves for studying creep and recovery processes can be plotted. In this way the elastic and plastic properties of a material can be recorded, and the hardness test can be made to a true rheological test. A durable indenter was found in the double cone diamond which is neither broken when in contact with hard surfaces, nor causes breakage of the indentations in brittle materials. Furthermore, it allows the determination of directional properties on cold worked metals and crystalline materials. 11 illustr, 24 ref.

X *Cvdb Wghd*

Electrophoretic deposition

Vitro Corp of America. *Metalworking Prodn* 1958 Vol 102 (44) pp 119-1921 (Oct 31)

Details of a process for applying metal and ceramic coatings. 3 illustr. *W* *Cz*

Wear resistance of metals and alloys subjected to friction against abrasive surfaces

K. V. Savitskii. *Izv vys ucheb zav; fiz* 1958 (2) pp 51-57; *Library of Congress Mthly Index Russ Access* 1958 Vol 11 (6) p 185 (Sep) (Original in Russian)

X *Bf Cw/Bfx Cw*

Concentrated wear of turning tools

V. Solaja, D. R. Cliffe. *Met Treatment & Drop Forging* 1958 pp 187-190 (May); *PERA Bull* 1958 Vol 11 (9) p 294 (Sep)

Describes tests carried out and the effect of wear on both tools and workpiece.

X *Ceqb Pd Unr*

A system of ore mineral identification

S. H. U. Bowie, K. Taylor. *Mining Mag* 1958 Vol 99 (5) pp 265-277 (Nov)

Reflectivity and microhardness tests are described. The hardness tester used was the GKN micro-indentation tester, using a square based diamond pyramid with a 136° included angle between opposing faces. A table shows the variation in hardness of similar minerals, *eg* pitchblende, from different localities. Variations in hardness caused by crystallographic orientation were observed in some specimens, *eg* zincite. 6 illustr, 7 tables. *W* *Bc Cvdb Wghd/Bc Ukg V*

Vickers hardness and compressive strength

D. S. Dugdale (Engg Dept, Univ Coll, Swansea). *Journ Mech & Phys Solids* 1958 Vol 6 (2) pp 85-91

Compression and hardness tests are reported for a wide variety of materials. A standard Vickers hardness tester with a pyramidal diamond indenter was used, and the load applied was such as would give the largest measurable impression, normally 100 kg. A simple empirical method for relating the hardness number to the stress-strain curve is suggested. The correlation obtained leads to the conclusion that the Vickers test is not at all sensitive to yield stresses corresponding to compressive strains greater than 0.15. 5 illustr, 7 ref, 1 table. *A* *Cvd Wghc*

Limits of wear of broach teeth and calculation of their pitch

P. G. Balyura. *Stanki i Instr* 1958 Vol 29 (8) p 100; *DSIR Transl Contents Lists Russ Period* 1958 (117) p 100 (Dec) (Original in Russian)

X *Cfm Pd Unr*

The structure of steel. IX. Mechanical test methods

E. Gregory, E. N. Simons. *E Allen News* 1958 Vol 37 (436) pp 223-226 (Oct); (437) pp 249-251 (Nov)

Details are given for tensile strength testing and hardness tests by the Brinell, Vickers, and Firth methods. Formulae for finding the Vickers hardness number from measurements of the diamond indentation are provided.

In the second part, Vickers and Firth methods are completed and hot hardness, Rockwell, and Avery hardness tests are described. In the latter tests, a diamond cone having a vertical angle of 120° and terminating in a spherical tip is used. Loads of 10 kg and then 140 kg are applied. 12 illustr, 1 table.

A *Bfd Cvd*

Dislocation motion associated with indentation

W. H. Vaughan J. W. Davisson. *Acta Metall* 1958 Vol 6 (8) pp 554-556 (Aug)

Letter to the Editor.

A study of etch pit patterns associated with indentations can reveal considerable information about the hardness and state of stress of a crystal. A change in hardness will be shown by a change in the distance of propagation of dislocations from an indentation produced by a reproducible punch such as the Tukon tester. This method of measuring hardness was used to study the changes induced by x-ray irradiation in a lithium fluoride crystal.

After the x-ray process, a series of indentations spaced 0.5 mm a part, traversing the shielded and x-rayed portions of the top and bottom surfaces of the crystal, were formed by means of a Tukon tester with a 135° Vickers diamond indenter using a 100 g load.

The size of indentations was measured and the crystal was then treated with an etch which revealed new dislocations. The change in size of the patterns was observed, and it was found that on the bottom surface the size decreased towards the x-rayed region, although the change was too slight to establish a change in hardness by the standard method. On the top surface a clear indication of hardness change was noticed, and asymmetrical patterns showed where a hardness gradient might be expected.

A different type of pattern was formed in the presence of stress. Since a series of surface patterns obtained on an as-grown (unannealed) LiF crystal show a progressive change in the stress asymmetry, the technique may be useful for detecting stress in opaque crystals. 4 illustr, 1 ref. *A* *Bd Cvd Ubb*

Microhardness of various glasses

Yu. V. Rogozhin & colls. *Trudy, Vsesoynz Nauk-Issl Inst Stekla* 1957 (37) pp 71-76 ; *Chem Abstr* 1958 Vol 52 (19) col 16713 (Oct 10) (Original in Russian)

The hardness values of numerous glasses ranging in quality from a lime-soda to a quartz were measured with the use of instrument PMT-3 (Vickers), the principle of which involves the correlation of hardness with the length of the diagonal of the impression made in the specimen with a weighted diamond pyramid. Formulated, $H = 2 \sin (\lambda/2) (P/D^2)$, where λ is the constant angle 136° of the diamond head, P the loading weight, and D the length of the diagonal in micron. Values of H obtained with this instrument are correlated with Mohs' values by the relations $H_o = 0.7\ H^{0.333}$. Directions for securing high precision are given in detail. In a series of parallel tests on specimens ranging in hardness from 566 to 1190 with a loading of 50 g, results with 70 g load agreed within less than 2%. *A* *Bm Cvdb Unhd*

Friction and titanium

P. D. Miller, J. W. Holladay. *Battelle Techn Rev* 1958 Vol 7 (11) p 14 (Nov)

Prevention of seizing and galling of titanium in rubbing contact with itself or other metals can be achieved by modifying the titanium surface and lubricating the modified surface. Nickel coatings, in conjunction with a cyanide, nitride, or fluoride composition, eliminate the friction and wear of the titanium. *W* *Bfn Cz Sb Ungd*

Method for measuring microhardness of thin layers

L. S. Palatnik, G. V. Fedorov, V. M. Kosevich. *Zavodsk Lab* 1958 Vol 24 (6) pp 759-761 ; *Library of Congress Mthly Index Russ Access* 1958 Vol 11 (7) p 2139 (Oct) (Original in Russian)

X *Bz Cvdb*

More surface polishing . . . less galling

W. H. Moore (Meehanite Metal Corp). *Product Engg* 1958 Vol 29 (48) pp 63-65 (Nov 24)

The effects of surface finish, ' wearing in ', lubrication, heat treatment, and density on the galling tendency in metals are considered. The testing apparatus is shown. 6 illustr. *W* *Bf Unr*

The wear and tear on books

Printing, Packaging and Allied Trades Res Assoc. *New Scientist* 1958 Vol 4 (108) p 1486 (Dec 11)

To determine wear on bookbinding materials, *eg* paper, leather, etc, a silicon carbide abrasive is directed at the specimen and the weight of grit needed to produce a hole is taken as a measure of its abrasion resistance. *W* *By Cw Rgc*

Temperature dependence of strength and brittleness of some quartz structures

J. H. Westbrook. *Journ Am Ceram Soc* 1958 Vol 41 (11) pp 433-440 (Nov)

The temperature dependence of the microhardness of the quartz structures of both SiO_2 and the isomorphous compounds $AlPO_4$, GeO_2, and $LiAlSiO_4$, has been examined.

Particular attention has been given to the effects of the high-low inversion, which has been found to be anomalous relative to the behaviour of other polymorphic transformations. The high quartz structure has been found to be much harder and more brittle than low quartz, despite their very close structural similarity. 13 illustr, 32 ref. *X* *Bcb Ubb Unh Vb*

Contribution to the practical application of microhardness testers. Ein Beitrag zur praktischen Anwendung des Mikrohaerteprueefers

L. Willing. *Radex Runds* 1958 (6) pp 313-316 (Sep) (In German)

An extension of the well-known nomogram for the determination of micro-hardness is suggested, which would make it possible to include the reading of the Meyer exponent. This is supplemented by several references regarding practical work with the Reichert microhardness tester. 3 illustr, 4 ref, 1 table. *A* *Wghd*

TRUING OF GRINDING WHEELS

Swivel diamond holder dresses grinding wheels better

F. Keesaw, Oakland, Calif. *Am Machinist* 1958 Vol 102 (21) p 122 (Oct 6)

The diamond holder is mounted and held by a grub screw in a 1 in. diameter steel ball. The ball fits into a half-spherical cavity and is retained by a threaded ring, thus providing a form of ball joint. 1 illustr. *W* *Ab Cg Nj Psf*

Diamond tools

D. Drukker & Zn, Sarphatikade 12, Amsterdam, Holland. *SA Mining & Engg Journ* 1958 Vol 69 (3429) p 875 (Oct 31)

A new truer for profile truing has four diamonds set end to end along the centre line of a steel or tungsten carbide holder. The diamonds are set in a powdered metal bond. When the diamond exposed at the end of the holder has been worn away, the bond concealing the second diamond is ground away, and that diamond is brought into use. *W* *Cgf Njd Urc*

Production of cash registers and accounting machines

National Cash Register Co (Mfg) Ltd, Dundee. *Machinery* (London) 1958 Vol 93 (2401) pp 1156-1168 (Nov 19)

Operations on small components are described, and details are given of the type of machinery used and tolerances observed. The diamond truing device on a Jones and Lamson thread grinder used in one operation is protected from excessive wear by a reduction in the wheel speed during the truing process. 19 illustr. *W* *Pz Qc*

Better diamond dressing for precision grinding

H. B. Patterson. *Grinding & Finishing* 1958 Vol 4 (7) pp 32-34 (Nov)

Diamond truing efficiency was measured on a Bryant Centalign grinder using 80 mesh aluminium oxide wheels on a workpiece of 60 RC hardness. The wheel was applied to the workpiece with a constant dead weight load, and movement of the wheel slide due to stock removal was recorded. The diamond truers used were the conventional single-point type. A graph shows results obtained with a dull diamond having a 1/32 in. flat in comparison to results with a sharp diamond. In another test, a wheel trued with a diamond with a flat ground on it showed only 19% of the cutting ability of a wheel trued with a sharp diamond. The effect of truing advance on stock removal and the effect of the trued surface on workpiece stock removal is discussed. A graph shows the effect of grinding pressure on stock removal and surface finish. The variables in wheel truing, *ie* diamond point shape, truing advance, and stock removal are briefly analysed. 4 illustr. *W* *Ab Cg Nj.131*

Semi-automatic for the complex (complete) double-profile truing of gears

L. M. Semenova & coll. *Stanki i Instr* 1958 Vol 29 (7) p 23 ; *DSIR Transl Contents Lists Russ Period* 1958 (116) p 152 (Nov) (Original in Russian)

X *Ad Cgf Pr*

Dressing and truing grinding wheels. Das Schaerfen und Abrichten von Schleifscheiben

Anon. *Technica* 1958 Vol 7 (19) pp 1047-1050, 1055-1058 (Sep 12) (In German)

A study of the use of diamond truing tools, which are used with quite different methods from those in other types of truing. The hardest materials can only be trued with natural diamond, and as such high demands are made on the tool, the stones must be free of inclusions and cracks. The size to be used varies according to the type of application and the size of the wheel. Recommendations for the most satisfactory conditions in using truing diamonds are given. They concern the speed, angle, and pressure of cut, grinding wheel speed, coolant—with a warning against application of cold fluid to a hot diamond—and how to deal with blunted diamonds. A detailed examination is made of the setting of truing diamonds in different types of machine. 25 illustr, 1 table.

A *Cg Nj Qr Sj*

New wheel dresser for Churchill type BW plain grinder

Churchill Machine Tool Co Ltd, Broadheath, Manchester. *Machinery* (London) 1958 Vol 93 (2403) p 1309 (Dec 3)

The new wheelhead-mounted profile forming unit of the Churchill BW 10 to 36 in. plain grinder can form shapes on wheels up to 6 in. wide. Steplessly variable traversing speeds of the slide are derived from a screw driven by a small electric motor which is interlocked with the workhead driving motor. The diamond holder, controlled by a template during the forming cycle, is vertically adjusted in increments of 0.0001 in. at the completion of each pass. 1 illustr.

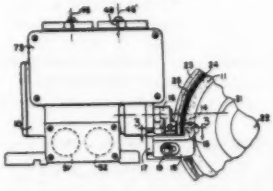
W *Abm Chch Pr/Abm Cg Nj Psf*

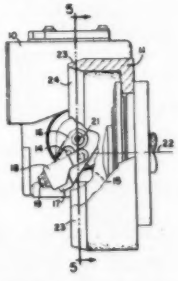
BP 804,406 (Oct 10, 1956) **A. Fumia, Gleason Works**

Wheel dressing devices

The device shown in Fig 1 *a* and *b* is used for truing

Fig 1 a *(below) and* b *(right). Two views of the diamond truing device described. BP 804,406.*





a cupwheel for grinding the opposite sides of gear teeth. There are two diamonds 14 and 15 mounted for swinging motion about a common axis across the opposite side faces 23 and 24 of the wheel 11. The diamond carriers are mounted the one on arm 16, the other on two-part arm 17, 18. The parts are relatively adjusted to one another to vary the spacing of the diamonds. The carriers are moved axially in time with their angular motion under control of cams and spring urged cam followers. The adjustment of the cams about an axis perpendicular to the axis of angular motion determines the pressure angle. By a further adjustment of each cam about an axis perpendicular to the axis of angular motion and to the pressure angle adjustment axis, the profile of the wheels may be made straight or curved. The diamond carriers are hydraulically operated by pistons 51 and 52. (12 claims, 7 illustr).

J *Abmd Cj Njc Psfb*

BP 804,413 (Jan 29, 1957) **L. Upton, John Watts (Sheffield & London) Ltd**

Grinding wheel dressers

The device belongs to the type of star wheel truing tools and is characterized by a metal guard in front of the handle detachable by a single wing nut. Side members on the guard are held in position by inwardly bent projections lying over the ends of the cutter spindle. (6 claims, 6 illustr).

J *Pf*

DAS 1,037,310 **J. Houldsworth, A. A. Jones & Shipman Ltd**

(Apr 3, 1952—conv date, Gt Britain)

Tailstock for grinding wheels. Reitstock fuer Schleifmaschinen

The truing diamond is arranged behind the centre mounted in a sliding member movable towards the workpiece and away from it. The diamond holder projects through an opening in the sliding member large enough to permit its movement for clamping and releasing the workpiece without requiring a long centre shaft which may lead to vibrations. (6 claims, 8 illustr). Ref cited : 1 GP ; 1 FP ; 1 USP.

J *Ab Cg Nj Psf*

DAS 1,039,436 (June 12, 1956) **E. Busch, Maschinenfabrik und Eisengiesserei A. Heinen GmbH**

Cutting machine for tobacco or other vegetable materials with planetary movement of circular rotary cutters arranged on a rotary cutter carrier. Schneidmaschine fuer Tabak oder andere pflanzliche Stoffe mit an einem Messertraeger angeordneten, planetenartig umlaufenden Kreismesserscheiben

The grinding wheel for grinding all the circular cutters arranged in the centre of the carrier is axially movable, its feed and drive being independent of the drive mechanism of the cutters. The wheel is periodically fed towards the cutters, and during the interruption of the grinding operation it is trued by a diamond radially movable into and out of the operative position. Hydraulic or electric control may be employed. (5 claims, 4 illustr). Ref cited : 2 DBP. Add DBP 1,015,733.

J *Ab Cg Nj/Al Chc Pe/Bz Ceg Pd Pr*

FINE BORING AND FINE TURNING OF METALS

Chrysler machines with job-tested oxides

B. C. Brosheer. *Am Machinist* 1958 Vol 102 (23) pp 108-113 (Nov 3)

Tool life was increased by a factor of 10 when triangular carbide inserts were replaced by square sintered oxide bits in rigid toolholders. They are used on steel worm shafts for power steering units. Suitable machining conditions for the tools are described. 10 illustr, 1 table.

W *Az Bfd Ceq Pdd Uqe*

Ceramic milling of ferrous materials

H. Frommelt. *Machine & Tool Blue Book* 1958 Vol 53 (11) pp 83-90 (Nov)

8 illustr. *W* *Bfc Cff Pdd*

Effect of lubrication coolants on temperature and force of cutting

B. M. Orlov. *Vestnik Mash* 1958 Vol 38 (7) p 64 ; *DSIR Transl Contents Lists Russ Period* 1958 (116) p 191 (Nov) (Original in Russian)

X *Ceg Uqg:Qr Sk*

Machine tool monitor using diffraction gratings

D. V. Blake, L. A. Sayce. *Soc Instr Techn Trans* 1958 Vol 10 (4) pp 190-196 (Dec)

A description of an instrument for measuring the errors in the saddle movement of a machine tool under normal working conditions using moiré fringes derived from a pair of diffraction gratings to provide an accurate linear scale of reference. Details are given of the application of the method to a high precision screw cutting lathe cutting threads up to 5,000/inch. The source and magnitude of the errors are discussed. The present instrument has errors of a few micro-inches. The method has also been applied with reduced accuracy to a normal engineering lathe, using photo-printers' ruled 'screens'. The error signals obtained from the instrument have also been used in a feedback loop to reduce the errors of the lathe. The application of this feedback to both types of lathe is briefly described. 10 illustr, 5 ref.

X *Ceqbd Pr Tfd.134*

Quality of workpiece in precision turning and grinding, and its influence on the production costs. Die Werkstueckguete beim Feindrehen und Feinschleifen und ihr Einfluss auf die Fertigungskosten

H. Schuler, P. H. Brammertz. *Ind-Anzeig* 1958 Vol 80 (97) pp 1471-14?0 (Dec 5) (In German)

In the precision turning and grinding of steel, the surface finish and form and measurement accuracy of specified standard workpieces were examined in relation to the chip conditions and the tools used. The tools were mostly of sintered carbide. Especially in the instance of precision turning, the influence of tool, workpiece, and machine tool on the accuracy of size and shape was thoroughly explored. Here, the cutting force, and above all the cutting temperature, have the greatest influence on the accuracy of shape. 32 illustr, 16 ref.

A *Bfd Ceqb Pd.131/Bfd Chc.131*

Precision turning pure titanium. Feindrehen von Reintitan

P. H. Brammertz. *Ind Anzeig* 1958 Vol 80 (89) pp 1345-134? (Nov 7) (In German)

Various cutting tests and conditions are described. Diamond used as a cutting material produced a good surface finish but was inclined to break under the high temperature produced by cutting. Of all the materials used, the three types of sintered carbide H1, H2, G1, were found to be the only satisfactory ones for precision turning pure titanium. 13 illustr, 3 ref.

A *Bfn Ceqb Nf Unf/Bfn Ceqb Pdc*

Testing of machinability by radioactive methods

B. Colding. *Acta Polytechnica Scandinavica, Mech Engg* Series 1958 (1) 73 pp ; *Battelle Techn Rev—Abstr* 1958 Vol 7 (11) p 757a (Nov) (No 14990)

A large number of machinability tests were carried out on five different work materials using radioactive carbide cutting tools. The tests were made in an ordinary lathe, provided with radiation shield. The wear on the carbide tools was determined by measurement or the radioactivity of the chips cut.

X *B Unp/Pdc Unr*

Testing cutting tools

A. Sadowski. *Polish Techn Abstr* 1958 (3) p 65 (Original in Polish)

Book, PWT, Warsaw. 1956, 330 pp, illustr.

Deals with testing of materials used for the production of tools, with tool measuring devices, and with methods of testing tools, reamers, milling cutters, and abrading tools. [Book not in library of Ind Diamond Inf Bur].

X *Al.1341.52*

BP 802,206 **A. H. Cooper, R. H. Booth, Electrical and Musical Industries Ltd**
(Oct 28, 1953 ; Feb 2, 1954)

Automatic control of machines for shaping workpieces

The shape of the workpiece is sensed in the rear of the cutting tool traversing the workpiece so that inaccuracies can be used to correct the position of the cutting tool and to control its position during a traverse after the first traverse has produced a shape not quite corresponding to the desired shape. The method can also be used for controlling roughing cuts followed by a finishing operation. Either the cutting tool of the workpiece, or both, may be repositioned by servomotor in accordance with the inspection signals coming from the sensing means which also may be displaced if desired. The example describes the arrangement in connection with the cutting of a cam of a certain profile. (11 claims, 5 illustr).

J *Ceq Pd Wp*

DAS 1,037,350 (July 27, 1957) **W. Bauer, E. Singer, Siemens-Schuckertwerke AG**

Method of producing bodies of sintered hard material, in particular for cutting tools. Verfahren zur Herstellung von Koerpern aus Sinterhartstoffen, insbesondere von Schneidwerkzeugen

The bodies are produced from a mixture of equal parts of vanadium nitride and aluminium oxide, to which titanium nitride may be added, which mixture is afterwards sintered. The bodies are suitable for cutting tools, drawing dies, et cetera. (3 claims).

J *Bz Cql*

DAS 1,037,806 (Nov 12, 1956) **W. Demand**

Lathe tool. Drehmeissel

The faces of the tool bar adjacent to the cutting edge are provided with a number of parallel grooves transversely situated in relation to the longitudinal axis of the bar (Fig 2). The depth of the grooves increases

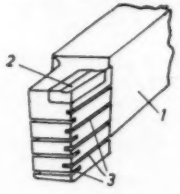


Fig 2. This diagram of the lathe tool shows shank 1, tool tip 2, and grooves 3. Better cooling is claimed. DAS 1,037,806.

towards the bottom of the bar. This permits a greater area to be presented to the surrounding air, and the formation of cracks by overheating of the tool tip, either when cutting or when re-grinding the edge, is prevented. (3 claims, 1 illustr). Ref cited : 1 GP.

J *Pd Uq*

DIAMOND TECHNOLOGY

First published 1942 as "Production Methods for Diamond and Gemstone." The second edition of this book by P. Grodzinski has been revised throughout and considerably enlarged. 840 pages, 486 illustrations, 94 tables, and indexes. From NAG Press Ltd, 226 Latymer Court, London W 6. 54s 6d, post free.

DAS 1,039,345 **J. L. Meijering, G. H. Broers, N. V. Philips' Gloeilampenfabrieken**
(Jan 21, 1956—conv date, Netherlands)

Method of machining porous tungsten with cutting tools. Verfahren zur Schneidbearbeitung von poroesem Wolfram

Porous tungsten cannot be machined unless impregnated with a low melting material which can be driven out again afterwards. Impregnation and removal can be carried out at much lower temperatures than those hitherto required by using an alkali metal halide as impregnant which does not react with tungsten at the temperature required for removal, and which is evaporated or dissolved after the machining operation. Sodium chloride is very suitable, and also halides such as NaF, KCl, KBr, RbCl, RbBr, and CsBr. The method is described with reference to a tungsten body welded to a molybdenum plate. Three sapphires are soldered on to the plate using a platinum solder. The tungsten body has to be turned and drilled and then precision ground (for a cathode structure). (3 claims, 1 illustr). Ref cited : 1 GP ; 1 FP ; 1 BP.
J *Bfp Ceq Scd*

CUTTING AND MACHINING OF GLASS

Glass question 264 : In the grinding and polishing of glass the temperature at which this treatment takes place plays a large role. It is requested that literature and suggestions be provided, indicating the temperatures at which grinding and polishing are most satisfactory. Glasfrage 264 : Beim Schleifen und Polieren von Glas spielt wohl die Temperatur, bei der diese Glasveredlungen vorgenommen werden, eine grosse Rolle. Es wird nun um naehere Angaben oder Hinweise auf diesbezuegliche Literatur gebeten, bei welchen Temperaturen das Schleifen und Polieren von Glas am guenstigsten durchzufuehren ist

Anon. *Glas-E-K-Technik* 1958 Vol 9 (11) pp 423-429 (Nov) (In German)

A long list of references on the subject is followed by five answers and a further short list of references. In keeping the right temperature the coolant plays an important part. With all glass machining, water is the coolant used, unless diamond tools are applied in which case oil mixed with paraffin is better. Abrasive powders, corundum (electro-corundum), carbides, and diamonds are recommended as fine polishing agents, in place of the quartz sand used in rough working.
A *Bm Chc Qr Sj Vb/Bm Chm Qr Sj Vb*

Instrumentation at the Mechanical Engineering Research Laboratory

Anon. *Instrument Practice* etc 1958 Vol 12 (8) pp 860-865 (Aug)

Various precision equipment is described, including a circular dividing machine for preparing scales with from 1,000 to 64,800 lines/inch. A diamond is used to cut the lines on an aluminized film on glass. 5 illustr.
W *Bm Cpf Nc Pr*

The Mk VII comprehensive auto edger

O. P. Raphael. *Mfg Opt* 1958 Vol 12 (2) pp 76-77 (Nov)

The Silver Wing Mark VII Auto Edger allows lenses of any type, form, power, shape, or size to be rimless- or bevel-edged from the uncut without touching the machine after the initial setting. The wear on the Silwing diamond wheel is evenly distributed, and the wheel does not have to be removed for treatment. A diamond truing device is provided for use with the grit wheel. 1 illustr. *W* *Bm Chc Nvd Pr*

Multiple-tubed recording manometers for quickly changeable pressures in the technique of measuring currents. Vielfach-Registrier-Manometer fuer schnellveraenderliche Druecke in der Stroemungsmesstechnik

W. Wuest. *ATM* 1958 (274) pp 225-228 (Nov) (In German)

Various instruments are described, the first being a direct inscriber which, in a version developed by the German Research Institute for Aeronautics, uses a diamond to write on a glass cylinder. 7 illustr, 23 ref.
A *Vb Wg*

Diamond-point engraving on glass

Anon. *Ind Diamond Rev* 1958 Vol 18 (214) pp 170-172 (Sep)

A description of diamond-point engraved glassware shown at the Crafts Centre, London. Works by Laurence Whistler and Anthony Pope are shown. 3 illustr. *W* *Bm Cp Ncb*

Relation of thickness of the relief and destruction of the layers of polished glass to the diameter of the abrasive grains

P. Ya. Bokin. *Steklo i Keram* 1958 Vol 15 (4) pp 8-10 ; *Am Ceram Soc Journ & Abstr* 1958 Vol 41 (9) p 231 (Sep) (Original in Russian)

Bokin gives a mathematical treatment of the subject, with photomicrographs of the abrasive grains.
X *Bm Chm Ubm*

The Edge-Master—Australian pencil edging machine

Diamond and Boart Products (Australia) Pty Ltd. *Ind Diamond Rev* 1958 Vol 18 (214) pp 177-178 (Sep)

This new machine is constructed to very fine tolerances in order to eliminate diamond wheel wear caused by vibration and out-of-round running. 1 illustr.
W *Chc Nvd*

Sealing glass to sapphire

L. S. Nelson, G. P. Spindler (Bell Tel Lab, Murray Hill, NJ). *Rev Sci Instr* 1958 Vol 29 (4) pp 324-326 (Apr)

In making sapphire discharge lamps it was necessary to seal ½ in. glass tubing to both ends of 5 to 7 in. long polished sapphire tubes of ½ in. outer diameter and ¼ in. wall thickness. Previously described methods were found unsuccessful, and a different combination of glasses, which is described, was used. 2 illustr, 3 ref, 1 table. *A* *Bbd Cq:Bm*

MACHINING OF STONE, ETC

The mechanical shaping of silicon carbide heating elements

P. N. Kudryavtsev. *Ogneupory* 1958 Vol 23 (4) p 156 ; *DSIR Transl Contents Lists Russ Period* 1958 (117) p 83 (Dec) (Original in Russian)
X *Ag Bk Ceq*

Diamond saws

W. F. Meyers Co, Bedford, Ind. *Mod Plastics* 1958 Vol 36 (3) p 260 (Nov)

Electro-bond saws are circular saws with diamond coated rims instead of the conventional teeth. They are particularly recommended for sawing reinforced plastic laminates and are available in diameters up to 24 inches. The maker also offers shaped diamond-coated tools. *A* *Ns Urd*

Painless drilling with high revolution speeds ? Schmerzloses Bohren mit hohen Touren ?

C. H. Fischer. *Umschau* 1958 Vol 58 (20) pp 626-627 (Oct 15) (In German)

Although progress has been made in the field of ultrasonic drilling on teeth, the level reached is not yet entirely satisfactory. It has been found, however, that at very high speeds drilling produces less easily perceived vibrations and therefore less pain to the patient. Special setting of diamonds in drills also improves them. The very high speed drills cannot yet be mass-produced in Germany, where the highest mass produced speeds are 12,000 to 40,000 rev/min, as compared with 300,000 rev/min in a turbine-propelled drill. 5 illustr. *A* *Cfb Uqfh*

Transistor production

Semiconductors Ltd, Swindon. *Machine Shop Mag* 1958 Vol 19 (12) pp 738-739 (Dec)

Various aspects of transistor production are described. The germanium crystals, 8 in. long by 1 in. diameter, are sawn into thin wafers by a diamond-impregnated saw operating at a high speed. After polishing, the wafers are scribed with a diamond tool to form a series of parallel lines. They are then cracked into strips by means of a vacuum pad, and the strips are made into rectangular blanks by the same process.
W *Bfr Ceg Ne/Bfr Cfm Cpf Nc*

ROCK DRILLING

Essen Mining Fair sets record for new equipment

Anon. *World Mining* 1958 Vol 11 (12) pp 34-38 (Nov)

A review of exhibits at the German Mining Exhibition, Essen, Sept 13-28, 1958.

The Longyear Hi-Speed air-leg diamond drill was shown ; it is powered by a 10 hp air motor and requires no swaging or bracing for drilling in line with, or at small angles to, the leg. 19 illustr.
W *Nh Pr*

Diamond drilling and coring

W. B. Brooks, L. W. Randerson, F. W. Schall. *Diamond News* etc 1958 Vol 22 (1) p 26 (Oct)

An extract of a review of drilling developments in the petroleum industry for the Fourth World Petroleum Congress.

Diamond drill bits are used successfully and economically for making full gauge holes where conventional bits require excessive round trips, and for maintaining gauge in drilling breaks encountered where diamond drilling and coring are being conducted alternately. Savings to be made by the use of diamond drilling offset the initial expense of the diamond bits.
W *Cfb Nhb.231*

Laws governing the motion of the cutting instrument while entering the rock

V. S. Fedorov, F. D. Zenkov, V. F. Dudin. *Dokl AN Azerb SSR* 1958 Vol 14 (6) pp 433-437 ; *Library of Congress Mthly Index Russ Access* 1958 Vol 11 (7) p 2184 (Oct) (Original in Russian)
X *Bn Cfb Pl Uq*

The PTT telescopic rock drill

E. A. Sorokin. *Biul tekh-ekon inform* 1958 (4) pp 5-6 ; *Library of Congress Mthly Index Russ Access* 1958 Vol 11 (6) p 1896 (Sep) (Original in Russian)
X *Pl*

Slim-hole drilling and completion practices, Cynthia Area, Pembina Field, Alberta

W. D. Freebon, D. R. Wright. *Canad Min & Metall Bull* 1958 Vol 51 (557) pp 590-594 (Sep)

A comparison of drilling and completion economics and practices has been made for slim-hole and conventionally completed wells. The diamond core head size in the conventional method was 7⅞ in., and in the slim hole method 6¼ inch. The bits used in the surface slim hole drilling were 9⅞ in. and 11 in., the former being used the more frequently. The average penetration rates with these were only slightly greater than those of the conventional 15 in. bit. In all cases the bits were retipped to extend bit life. For the below-surface drilling, soft formation type rock bits were used, *ie* the conventional 9 in. and the slim hole 6¼ in. For these the penetration rates were more or less equal, but 15% more bits/well were required of the smaller ones. Costs of completion of the slim holes was reduced by 37%. 3 illustr, 2 tables. *A* *Cfb Nhc*

Welding and hardfacing of rock bits

Anon. *Mech World* etc 1958 Vol 138 (3472) pp 511-512 (Nov)

Three-cone rock bits are manufactured in diameters between 5¾ and 12¼ inches. In each size there are various designs of cutter profiles and teeth adapted to various formations. The teeth of the cones are faced with tungsten carbide. 1 illustr.
W *Pl Uqp*

Fast core drilling machine moves as easily as it cuts

Mo'co Drilling Machines Inc, 1100 20th St, NW, Washington, DC. *Engg News-Rec* 1958 Vol 161 (9) p 56 (Aug 28)

The Model V Mole diamond core drilling machine can drill 14 in. diameter holes through reinforced concrete at a rate of 4 in./minute. The drill is petrol driven and easily transportable.
W *Bny Cfb Nhe Pr*

DAS 1,039,006 (Nov 17, 1954) **H. Huegel**

Core catching device for deep drilling tools. Kernfangvorrichtung fuer Tiefbohrwerkzeuge

As shown in Fig 3*a* and *b*, which represent one embodiment of the invention, the drill has wing-like cutting edges 12. The catcher housing 13 is screwed on to core pipe 14 and provided with three catcher fingers 15 hinged to housing 13. On raising core pipe 14, rods 16 are pushed downward and engage with their tapered ends correspondingly tapered faces on fingers 15, pressing the fingers into the core which is thus torn off. (3 claims, 9 illustr). Ref cited : 1 USP.
J *Cfb Pl Pr Ps*

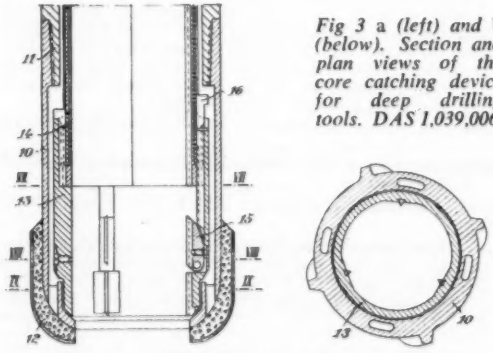


Fig 3 a *(left) and* b *(below). Section and plan views of the core catching device for deep drilling tools. DAS 1,039,006.*

WIRE DRAWING

Repair of wire drawing equipment

Ya. A. Amlinskii. *Library of Congress Mthly Index Russ Access* 1958 Vol 11 (7) p 2254 (Oct) (Original in Russian)

Book, Gos naucho-tekhn izd-vo lit-ry po chernoi i tsvetnoi metallurgii, Moscow. 1958, 163 pp. [Not in library of Ind Diamond Inf Bur].

X *Cn Pr Qc.52*

Recrystallisation of tungsten wires. I & II

G. L. Davis (Mullard Radio Valve Co Ltd). *Metallurgia* 1958 Vol 58 (348) pp 177-184 (Oct); (349) pp 228-232 (Nov)

23 illustr, 30 ref. *W* *An Bfp Cz*

Boring and polishing machine type ME 1 for drawing dies. Ziehstein-Bohr- und Poliermaschine Typ ME 1

S. Eder, Wien-Oberlaa, Austria. *Draht* 1958 Vol 9 (11) pp 468-469 (Nov)

This machine enables five operations to be performed at the same time in polishing drawing dies with wire: the rotation of the die; the movement of the wire through the die (about 80 oscillations/min); constant gradual feed of new wire; superimposed oscillations to 500, 1,000, 3,000 and 4,000 strokes/min; and automatic swinging of the die between 8 and 28°, which can be controlled by means of a scale. Boron carbide with diamond dust added is used as the polishing material for sintered-carbide dies. A table shows times taken for polishing diamond dies, and the centring device is described. 2 illustr, 1 table.

A *Az Chmg Pr*

New techniques in drawing chromium-vanadium wire used for springs

V. V. Fedorov, Ya. Kh. Sartan. *Biul TSNIICHM* 1958 (10) pp 48-49; *Library of Congress Mthly Index Russ Access* 1958 Vol 11 (7) p 2254 (Oct) (Original in Rusisan)

X *An Bfxz Cn*

Wire manufacture at Stocksbridge

Samuel Fox & Co Ltd, Stocksbridge. *Wire Industry* 1958 Vol 25 (299) pp 1053-1056, 1057 (Nov)

A review of plant and production methods at the Stocksbridge works. 8 illustr.

W *Cn Pr*

A heavy intermediate wire-drawing machine

Winget-Syncro Ltd, Rochester, Kent. *Wire Industry* 1958 Vol 25 (299) p 1048 (Nov)

The D-14 heavy intermediate wire drawing machine handles a maximum entry size of 5/16 in. diameter soft rod, with a finishing range from 0.128 to 0.0403 in., according to the entry size. The machine can be supplied to spool only, to coil only, or to spool and coil. It can also be supplied with annealer and Reelomatic spooler for continuous spooling of annealed copper wire. The maximum finishing speed is 3,500 ft/min, and the maximum number of die positions is 14. 1 illustr.

W *Cn Pr*

GRINDING AND POLISHING OF HARD METALS

Grinding high speed cutting tools

I. Alfimova. *Sel'mekh* 1958 (5) pp 36-38; *Library of Congress Mthly Index Russ Access* 1958 Vol 11 (7) p 2138 (Oct) (Original in Russian)

X *Al Chc*

Sharpening tools for chip machining metals. Das Schaerfen der Werkzeuge fuer die spanabhebende Metallbearbeitung

G. Lichtenauer. *Industrieblatt* 1958 Vol 58 (11) pp 479-486 (Nov) (In German)

Details are given concerning turning and hobbing tools and thread drills. The section on turning tools includes a description of the double diamond fine mesh grinding wheel, which may be used in place of the usual diamond grinding wheel used for precision grinding. It consists of two ring wheels fixed on the same centre, of which the outer ring has a comparatively coarse mesh for rough grinding, and the inner a fine mesh for finishing. Whichever wheel is to be used is brought forward away from the other. On another machine, a silicon carbide wheel is used to work the tool shank at an angle up to 2° greater than the clearance angle, and then three wide diamond grinding wheels are used to grind the cutting face, the rough grinding of the clearance angle being still at an angle about 1° greater than the finish grinding. This saves excessive wear on the diamond wheel. 29 illustr, 10 ref.

A *Al Chc Nv/Az Chc Pe Rgc*

Reduce residual stress in ground parts by correct wheel selection

J. A. Mueller. *Metalworking Prodn* 1958 Vol 102 (48) pp 2085-2087 (Nov 28)

A summary is given of results obtained by the Grinding Wheel Institute of America following tests to determine how the magnitude and distribution of grinding stresses is affected by the choice of grinding wheel. Tests were carried out on steel using aluminium oxide wheels. The following information was derived: (*i*) to grind with a minimum of residual stress, use soft grade wheels; (*ii*) harder wheels last longer and have higher abrasive efficiency, but some quality must be sacrificed; and (*iii*) the end product governs the choice of wheel, and wheels can be selected to produce end products that vary over a wide range, both in quality of grind and apearance. 6 illustr.

W *Bfd Chc Pe Rj Unq*

A guide to rough grinding carbide tools

R. A. Parke (Norton Co). *Grinding & Finishing* 1958 Vol 4 (7) pp 28-30 (Nov)

Prior to finish grinding on a diamond grinding wheel, carbide tools are rough ground with silicon carbide. The article is in question-and-answer form, and a summary of the answers provides the following advice: Select a wheel which will (*i*) just break down readily on the largest tool to be ground; (*ii*) break down readily when used by the operator employing the lightest grinding pressure; (*iii*) break down readily when grinding the relief on steel shanks. The grit should be small enough to prevent chipping, flaking, or saw-tooth edges on the hardest carbides to be ground. Wheels should be supplied with a flood coolant and operated with minimum grinding pressure in order to save wheel wear and obviate excessive heat. 3 illustr.

W *Al Bkc Chc Pe Rgc/Al Bkc Chc Nv*

Grinding thread drills and cutting dies. Schleifen von Gewindebohrern und Schneideisen

Anon. *Technik & Betrieb* 1958 Vol 10 (11) yellow insert pages (Nov) (In German)

(Cont). Threads are often spoiled when small particles are pressed into the sides of the cutting die. This can be avoided by the use of a knife file, followed by a dressing stone to finish off the work. Instructions are also given for ensuring that the polished surface of the throat is even, and for grinding the die. Recommendations as to the best chip angle, rake angle, and cutting speed are made. 3 illustr. *A* *Chcp*

New techniques for grinding sintered carbides

E. Zmihorski. *Machinery* (London) 1958 Vol 93 (2401) pp 1186-1188 (Nov 19)

Sintered carbide tools can be rough ground on corundum wheels by heating the tools to 750-850 deg C before grinding, and maintaining the temperature during the grinding process. Theoretically, this should soften the bond between carbide tip and tool, but this has not occurred in practice. To obviate the possibility, however, a special set-up is described which holds the tool and tip firmly together during grinding. Faster grinding is claimed for this method, and tools ground in this way can be used at higher cutting speeds than usual.

For finish grinding, an electrolytic method using metal-bonded corundum or silicon carbide wheels has been developed. Ground surfaces with a 0.15 micron roughness can be produced, with metal removal rates up to 0.025 cub in./minute. 3 illustr.

W *Al Bkc Chc Pe Rgc Urc/Al Bkc Chc Pe Rjc/Al Bkc Chc Pe Rjc Urc*

Developments in gear cutting and finishing

Anon. *Machinery* (London) 1958 Vol 93 (2404) pp 1364-1370 (Dec 10)

General rules and warnings are provided for the production of gears, including a description of the Maag 0° gear grinding process. 6 illustr, 4 ref.

A *Ag Chc Pr*

Calculating allowances for grinding

A. N. Spasskii. *Avt prom* 1958 (4) pp 30-32 (Apr); *Library of Congress Mthly Index Russ Access* 1958 Vol 11 (6) p 1815 (Sep) (Original in Russian)

X *Chc*

A precision drill grinding machine with built-in projector. Kleinbohrerschleif-maschine mit eingebautem Projektor

A. Tatar, Stuttgart-Botnang. *Werkstatt & Betrieb* 1958 Vol 91 (10) pp 620 (Oct) (In German)

The machine is the 0.3 to 10 mm Tatar on which the drill point is magnified 10 to 40 times by an attached projector. The truing of the grinding wheel is effected by a movable lever which indicates the correct position of the wheel. Point angles of 60 to 180° and clearance angles, both back and front, of 0 to 30° on left- and right-hand drills of 0.3 to 10 mm diameter, can be ground on this machine. The motor operates at 2,800 rev/minute. 2 illustr.

A *Alb Chc Pr*

Grinding bent and curved parts

Anon. *Der prom* 1958 Vol 7 (5) pp 30-31 (May); *Library of Congress Mthly Index Russ Access* 1958 Vol 11 (7) p 2138 (Oct) (Original in Russian)

X *Ag Chc*

Grinding machine

Cincinnati-Nederland NV Co, Vlaardingen, Holland. *SA Mining & Engg Journ* 1958 Vol 69 (3429) p 875 (Oct 31)

A new cylindrical grinder for workpieces 250 mm in diameter and 600 mm long incorporates a profile tracing mechanism which copies profiles to a depth of 19 mm. A diamond tracing stylus is employed.

W *Chch Nb Pr*

Cracks caused by grinding and measures for their elimination

G. L. Levin. *Vestnik Mash* 1958 Vol 38 (6) pp 55-57 (June); *Library of Congress Mthly Index Russ Access* 1958 Vol 11 (7) p 2138 (Oct) (Original in Russian)

X *Chc Unt*

Principles and applications of honing fixtures

J. H. Greening (Micromatic Hone Corp). *Tool Eng* 1958 Vol 41 (5) pp 91-95 (Nov)

Set-ups designed to permit various honing operations are described. 9 illustr.

W *Chh Pr*

Contribution to the metallographic grinding technique. Beitrag zur metallographischen Schleiftechnik

H. Klemm, K. Wiegmann. *Fertigungstechnik* 1958 Vol 8 (11) pp 507-510 (Nov) (In German)

12 illustr, 3 ref.

A *Bfa Chc*

Grinding fixture

Lennie & Thorn Ltd, Western Road, Bracknell, Berks. *Machinery Lloyd* 1958 Vol 30 (23A) p 61 (Nov 15)

A new surface grinder grinds irregular-shaped punches, broaches, etc, in 15 min, with a setting accuracy of 0.0002 inch. A special radius truing attachment allows forms from 1¼ in. convex to 1½ in. concave to be generated on surface grinding wheels.

W *Al Chcm Pr/Psfc*

Grinding shaped workpieces on a magnetic plate by copy-profiled grinding wheels

B. M. Malkin. *Vestnik Mash* 1958 Vol 38 (6) pp 74-76 (June); *Library of Congress Mthly Index Russ Access* 1958 Vol 11 (7) p 2138 (Oct) (Original in Russian)

X *Az Chc Pe*

Diamond wheel markings . . . secret of successful carbide grinding

H. F. McGlory. *Carbide Engg* 1958 Vol 10 (11) pp 13-17 (Nov)

The diamond grinding wheel classification system is explained: on a wheel marked D 150 N 4 B A ¼, D is the abrasive, 150 the mesh size, N the grade, 4 the concentration, B the bond type, A the bond modification, and ¼ the diamond depth in inches. Following a discussion of the factors indicated on the grinding wheel is an explanation of the hardness or 'grindability' of carbide. Ten rules summarize the information necessary for obtaining the best results from grinding carbides with diamond. 4 illustr.

W *Bk Chc Nv/Bk Unge/Nv.2556*

Automatic grinding with coated abrasives . . . finds widespread use of roughing, finishing and polishing

J. K. McLaughlin (Norton Co). *Machinery* (NY) 1958 Vol 64 (12) pp 121-136 (Aug)

Describes the increasing use of abrasive belt grinding methods. A table provides a guide to the selection of contact wheels, and a further table aids the selection of abrasive belts. The abrasives used are aluminium oxide and silicon carbide. 15 illustr, 2 tables.

W *Chc Pee Rgc/Chc Pee Rj*

Grinding space age materials

J. A. Mueller (Carborundum Co). *Tool Eng* 1958 Vol 14 (5) pp 127-128 (Nov)

Dense silicon carbide requires two grinding operations: a diamond wheel should be used for removing stock down to dimensions, with a silicon carbide wheel for a final polishing. High purity dense alumina can be ground with diamond or with non-diamond wheels. Sprayed coatings should be roughed with 100 mesh resin-bonded diamond wheels which give fast stock removal, and can be finished with vitrified-bonded silicon carbide. Silicon carbide is also recommended for grinding zirconium. Molybdenum should be ground with aluminium oxide. 4 tables.

W *Bkc Chc Nv/Bkc Chc Re Rgc/Bhc Chc/Bz Chc Nv Urb/Bz Chm Pe Rgc Urf/Bfu Chc Pe Rgc/Bfq Chc Pe Rj*

First practical results with diamond grinding wheels made from synthetic diamonds. Primi risultati pratici delle mole diamantate fabbricate con diamante artificiale

N. A. Matthews, N. Leventhal (Gen Electr Co). *Macchine* 1958 Vol 13 (8) pp 733-738 (Aug) (In Italian)

See *Ind Diamond Abstr* 1958 Vol 15 p A141 (Sep).

M *Nv:Fh*

Tools, instruments, dies. Werkzeuge, Vorrichtungen, Stanzen

F. Puehler. *VDI-Zeits* 1958 Vol 100 (33) pp 1595-1597 (Nov 21) (In German)

Amongst the instruments described are grinding, honing, and lapping machines. A new electrolytic grinding method, particularly suited to the grinding of difficult workpieces, is described. In honing with diamond tools of small diameter on horizontal honing machines, a considerably longer life resulted from reversing the direction of rotation after 20 to 25 revolutions. 3 illustr, 26 ref.

A *Chcr Pr/Chh Nqe Uqc*

Rationalization and improvement of metallographic grinding and precision grinding techniques. Rationalisierung und Verbesserung der metallographischen Schleif- und Feinschleiftechnik

C. G. Nestler, F. W. Guenther. *Fertigungstechnik* 1958 Vol 8 (11) pp 504-506 (Nov) (In German)

Dry grinding with the various abrasive papers is the most common and the most uneconomical method. An improvement on this is the Lunn wet grinding method, and an entirely different technique is that of diamond polishing. In the watch glass industry diamond dust has long been used for grinding, but the new form of diamond grinding is carried out with diamond pastes. The slower methods of grinding, which, however, provide an excellent surface finish, are the main subject of the article. Tungsten carbide is the abrasive used. 2 illustr, 14 ref, 1 table.

A *Bfa Chc/Bm Chm Kmg Tlbb/Bm Chm Rgd Tlbb*

Grinding and polishing. Das Schleifen und Polieren

C. Rahaberger. *Dtsch Uhrmacher Zeits* 1958 Vol 62 (11) pp 529-530 (Nov) (In German)

A *Chc/Chm*

A combined electrolytic polisher and microscope

F. Ruemmele. *Engs Digest* 1958 Vol 19 (11) pp 479-481 (Nov)

The new Zeiss electrolytic polishing equipment for metallographic specimens incorporates an integral microscope through which the specimen can be observed and/or photographed without interrupting the polishing process. The equipment is designed so as to keep constant as many of the influencing factors as possible, *eg* size of surface being treated. 4 illustr.

A *Bfa Chmk Pr Wcm*

A film attachment for recording the reactions in the diamond wheel structure. Eine Filmeinrichtung zur Erfassung der Vorgaenge im Schleifscheibengefuege

K. E. Schwartz. *Ind Anzeig* 1958 Vol 80 (92) pp 1391-1395 (Nov 18) (In German)

An attachment has been developed and tried out with which it is possible to record the reactions of a particular point in the abrasive layer of a grinding wheel. The apparatus makes use of a small film camera, a light-flash stroboscope, synchronizing instruments, and an optical rectifier. Thus it was possible to describe the wear phenomena of grinding wheels in their space and time sequence, and to draw conclusions about the chip process in grinding. 11 illustr, 4 ref.

A *Nv Unr V Wcf*

High efficiency unified circular grinding machines

M. Valli. *Stanki i Instr* 1958 Vol 29 (8) p 9; *DSIR Transl Contents Lists Russ Period* 1958 (117) p 100 (Dec) (Original in Russian)

X *Chc Pr*

BP 802,297 (Aug 27, 1956) **C. Klingspor**

Grinding discs

The disks are built up of a number of superimposed abrasive coated rings impregnated and bonded by synthetic resin. The rings are preferably abrasive paper with concentric grooves or depressions on one or both flat surfaces. The bonding may be carried out in a resin press at 150 kg/sq cm at 165 deg Centigrade. (6 claims, 8 illustr).

J *Pe Urb*

DAS 1,036,697 (June 27, 1957) **E. Rotzoll, H.-O. Schmidt Herminghausen Werke GmbH**

Device for preventing grinding off small areas when tilting workpieces off the workpiece support of centreless circular grinders for continuous grinding. Einrichtung zur Vermeidung des Anschleifens kleiner Flaechen beim Abkippen der Werkstuecke von der Werkstueckauflage spitzenloser Rundschleifmaschinen beim Durchgangsschleifen

The device consists of a small discharging disk adjacent to and concentric with the grinding wheel. The workpiece passes the discharging disk after being ground to size and remains in contact with this disk until free from the grinding zone; only then is it tilted off. (1 claim, 1 illustr).

J *Chc Pr Ps*

DAS 1,038,433 **H. G. Lux, N. Jenikowsky** (Dec 27, 1952—conv date, Austria)

Grinding wheel. Schleifscheibe

A slotted grinding face enables the operator to watch the progress of the grinding operation. A further improvement is obtainable by providing inclined slots. These produce a propeller-like action of the wheel, and cause a cooling effect which may even replace liquid coolant. The slots may be so arranged that their extension would intersect the wheel axis; this could be combined with the arrangement of a light source with a conical shade reaching into a recess in the wheel face or inside the upstanding rim of a cover plate. (3 claims, 7 illustr). Add DBP 948,128. Ref cited: 3 GP; 1 DBP; 2 Swiss P; 1 USP.

J *Pe Uq*

DAS 1,038,434 (Dec 23, 1953) **H. G. Lux, N. Jenikowsky**

Grinding wheel. Schleifscheibe

The openings in the wheel as described in DBP 948,128 have a dull and, if possible, black surface on that side which is opposite the observer. (1 claim). Add DBP 948,128.

J *Pe*

DAS 1.038,435 (March 20, 1954) **W. Osenberg**

Grinding tool for materials of high strength and hardness with hard metal grinding rings concentrically arranged on a carrier disk. Schleifwerkzeug zur Bearbeitung von Werkstoffen hoher Festigkeit und Haerte mit konzentrisch auf einer Traegerscheibe angeordneten Hartstoff-Schleifringen

The grinding rings consist of hot pressed granular hard material *eg* boron carbide. The rings cut with a triangular profile, *ie* have a fairly sharp cutting edge with which they contact the workpiece, and not a cutting face which, when using cup wheels required for grinding cutting tools, easily leads to overheating and cracks. The height of the concentric cutting edges may

increase towards the centre. Fig 4 shows cross sections through two practical embodiments with three separate rings 5_1, 5_2, 5_3, or with a profiled ring 6 on a support 1.

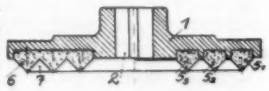


Fig 4. The left-hand side of the diagram shows the tool using a profiled ring; on the right, three separate rings. DAS 1,038,435.

The exact profiles are produced by truing with a hard material or diamond tools after fixing the rings on the support. The rings may be intersected by radial cuts to improve the grinding effect. (4 claims, 6 illustr). Ref cited : 1 DBP ; 1 Swiss P ; 4 USP.

J *Chc Pe*

DAS 1,034,507 (March 20, 1954) **N. W. Thibault, G. E. Comstock, Deutsche Norton GmbH**

Grinding wheel for electrolytic grinding. Schleifscheibe fuer elektrolytisches Schleifen

Ceramic bonded wheels, *eg* of silicon carbide or aluminium oxide, are almost non-conductors and, therefore, unsuitable for electrolytic grinding. Metal-bonded wheels as used for grinding tools of hard materials, *eg* diamond or silicon carbide wheels, can only be used if too strong an electrolytic effect or arcing is prevented. This means a limited current reducing efficiency. These drawbacks are overcome by using wheels of preferably porous recrystallized silicon carbide. Although such wheels have very low conductivity it is sufficient for the purpose and it permits grinding without taking special precautions, and with much greater efficiency. The wheel is made without additional bonding material from a mixture of silicon carbide grains and a sodium silicate solution. (2 claims).

J *Chcr Pe Rgc*

NEW MACHINING METHODS

The re-servicing of carbide tools

Anon. *Australasian Manufacturer* 1958 pp 44-46, 48, 50-51, 60-62, 65 (June 7) ; *PERA Bull* 1958 Vol 11 (11) p 358 (Nov)

Discusses both conventional methods and the recently developed spark erosion process for servicing carbide tools.

X *Al Bk Ceqn/Al Bk Chc*

Electro-erosive boring of minutes bores

M. Doerfel, H. Klemm, H. Wappler. *Fertigungstechnik* 1958 Vol 8 (11) pp 501-503 (Nov) (In German)

5 illustr.

A *Ceqn*

Ultrasonic machine for hard materials processing

M. G. Kogan. *Vestnik Mash* 1958 Vol 38 (11) p 92 (In Russian)

X *Ba Ceqr Pr*

Characteristic magnitudes of spark erosive working on metals. Kenngroessen funkenerosiver Metallbearbeitung

H. Rossa. *Fertigungstechnik* 1958 Vol 8 (11) pp 497-501 (Nov) (In German)

8 illustr, 3 ref.

A *Bf Ceqn*

Ultrahigh-speed machining . . . panacea or pipedream ?

A. O. Schmidt (Kearney & Trecker Corp). *Tool Eng* 1958 Vol 41 (5) pp 105-109 (Nov)

A discussion of the factors involved in ultra high speed machining. 7 illustr, 14 ref.

W *Ceq Uqfb*

The application of spark erosion machining

A. J. Lawrence. *Inst Prod Engs Journ* 1958 Vol 37 (11) pp 694-709 (Nov)

24 illustr, 3 ref.

W *Ceqm*

Concerning the physical nature of electrospark machining of metals

B. N. Zolotykh. *Trudy Tsentral'noi Nauch-Issledov Lab Elek Obrab Materialov* 1957 Pt 1 p 38 ; *DSIR Transl Contents Lists Russ Period* 1958 (116) p 180 (Nov) (Original in Russian)

X *Bf Ceqm*

Electrolytic polishing of metals and the structure of the polished surface

G. S. Vozdvizhenskii, G. A. Gorbachuk, G. P. Dezider'iev. *Dokl An SSSR* 1958 Vol 120 (1) pp 101-102 (May-June) ; *Library of Congress Mthly Index Russ Access* 1958 Vol 11 (7) p 2120 (Oct) (Original in Russian)

X *Bf Chmk Ubm*

DAS 1,034,786 (Feb 27, 1952) **K. H. Steigerwald, Carl Zeiss**

Method of making spinnerets. Verfahren zum Herstellen von Spinnduesen

The hole or holes of a length greater than 0.5 mm are produced in metal or ceramic materials by means of a jet of charged particles, *eg* by a jet of electrons. The diameter of the jet should be smaller or equal to that of the hole to be drilled. If the current and the speed of the electrons is large enough, the material of the spinneret can be heated in a very short time to produce a hole at the point hit by the jet. Through shaping the jet of electrons accordingly, conical holes or non-circular holes may be produced. The method is especially effective when drilling bad heat conductors like aluminium oxide or other metal oxides, glass, or hard porcelain. (9 claims, 6 illustr). Ref cited : 1 GP.

J *Cfbm*

POWDER TECHNOLOGY

The pneumatic grading of finely crushed material

A. M. Polotskii. *Khim Nauk i Promysh* 1956 (2) pp 199-204 ; *DSIR Transl CTS* No 503, 1958, 7 pp (Nov) (Original in Russian)

Finely crushed material is obtained from a grinding plant which includes classification equipment as well as the grinding mill itself. The classification system separates the ground products into fractional sections of different dimensions. The most widespread method of classification of particles in the dry crushed state is by pneumatic grading. 13 illustr, 5 ref, 1 table.

W *B Cl Vg Wj*

Dust precipitation by sonic and ultrasonic vibrations

A. Willner. *Bergbau-Technik* 1955 Vol 5 pp 201-209 (In German)

Deals with the theory of agglomeration of dust by ultra-sound, particle sizes, concentrations, and other aspects of the process. [Transl av, H. Brutcher, PO Box 157, Altadena, Calif. Price : $13.75, No 4404].

W *Ty Vgh*

LITERATURE REQUESTS

When applying for the loan of literature abstracted in this journal, please quote the title of the article, the name of the author, and the number of the page on which it appeared.

DIAMOND RECOVERY

Diamond powder recovery with heavy liquids

J. Swimmer. *Ind Diamond Rev* 1958 Vol 18 (212) pp 136-138 (July); (213) pp 149, 152 (Aug)

Reduced toxicity methylene iodide is a suitable heavy liquid for separating diamond powder from mixed abrasives, metals, and metal carbides. After preliminary cleaning, the powder for separation is mixed with 10 times its weight of methylene iodide and centrifuged. The whole of the subsequent separation process is described. 5 illustr, 5 ref.

W *Km:Hvf*

In-plant 'diamond mines' are expensive . . . spot yours and save

C. E. Reuss. *Tooling & Prodn* 1958 Vol 33 (11) pp 67-78 (Feb); (12) p 69 (Mar); *Ind Diamond Rev* 1958 Vol 18 (210) pp 96-99 (May); (211) pp 106-110, 112 (June); (212) pp 126-128, 130 (July); (213) pp 146-148 (Aug); abstr *Ind Diamond Abstr* 1958 Vol 15 p A107 (July)

19 illustr, 3 tables. *W* *N.145*

SURFACE FINISH TESTING

Workshop instrument for the control of surface roughness of ground plane glass

G. M. Gorodinskii. *Izmeritel Tekh* 1958 (4) pp 26-27 (July-Aug); *BSIRA Bull* 1958 Vol 13 (11) p 313 (Nov) (Original in Russian)

The instrument described is based on the principle of light reflected from matt surfaces. The intensity of reflected light, which depends on the surface condition, is measured by means of a photocell coupled with a micro-ammeter. *X* *Bm Vs Wgf*

Precision machining of sliding surfaces and effects achieved. Die Feinbearbeitung von Gleitflaechen und ihre Auswirkung

W. Ploettner. *Fertigungstechnik* 1958 Vol 8 (11) pp 511-517 (Nov) (In German)

The definition of surface finish is discussed and a list is given of precision machining methods. One of these is diamond turning, which has the advantage of using the hardest material and the disadvantage that this is also a very brittle one. With diamond the cutting surfaces are always at a wide angle. In the paragraph on precision die polishing, details are given of a machine made by VEB WTB-Werkzeugmaschinen, Dresden, in which the polishing is done by a diamond-impregnated resin-bonded disk, mesh size 0.5 micron. Methods of surface finish testing are also described. 17 illustr.

A *Ceqb Nf/Chm Nv Urb:Tb/Unf.255*

Surface indicator teams with huge die grinder

Anon. *Am Machinist* 1958 Vol 102 (23) p 113 (Nov 3)

A Mattison surface grinder produces precision plates, 150 in. long and 80 in. wide, to tolerances of 0.001 inch. A Brush Surfindicator is used for surface finish measurements. The Surfindicator uses a diamond stylus with a 0.0005 in. diameter tip. 1 illustr.

W *Chm Pr/Cx Nd*

Surface finishes—carbide vs oxide

L. A. Sowinski (Gen Electr Co). *Tooling & Prodn* 1958 Vol 24 (8) pp 53-56 (Nov)

Tests described showed that for precision or light machining and long tool life on steel, sintered oxides are usually superior to tungsten carbide. For uniform finish, sintered carbides are preferable. 5 illustr, 4 ref.

W *Bfd Ceq Pdd Uqe/Bfd Ceq Pdc*

CORRIGENDUM

See *Ind Diamond Abstr* 1958 Vol 15 p A151 (Oct)

The polarization of luminescence in diamond

For '1956' read '1958'.

PUBLICATIONS RECEIVED

BOOK REVIEWS

Fine grinding and lapping, Machinery's Yellow Back Series No 19

Machinery Publishing Co Ltd, National House, West St, Brighton 1. 74 pp, illustr. Price : 5s 0d

Although it is small enough to fit in the pocket, the book yet manages to give a sound and workmanlike treatment to its subject. Both operations with which the book deals involve the use of industrial diamonds, and this aspect is dealt with at some length.

The fourteen chapters cover surface quality, factors affecting grinding machine operation, the choice, use, dressing, truing, and balancing of grinding wheels, selection of coolants, and all aspects of lapping. The difference between dressing and truing is made clear, and these two subjects are dealt with separately. Under the chapter on grinding wheel dressing, separate sections are devoted to diamond dressing tools and the holding of the diamond tool. A table shows the best diamond size for different dressing applications. There is also a section on dressers using more than one diamond, and one on technique in dressing wheels with a diamond. The chapter on truing tools describes the different types of diamond truer available, and the operations that can be performed with them.

The chapters on lapping are as comprehensive as those on fine grinding, and advice is given on the use of diamond abrasives.

This book would be an excellent addition to an engineer's library, and is especially suitable as a text-book for apprentices.

W *Chcw.52/Chd.52*

Basic procedures of diamond and shot core drilling

Acker Drill Co Inc, Scranton, Pa. 1956, 33 pp, illustr. Price : $1.--

As the title indicates, only the basic procedures of its subject are dealt with in this booklet. The chapter headings are : (*i*) Setting-up the core drill ; (*ii*) Driving the casing ; (*iii*) Diamond core drilling ; (*iv*) Hints for successful drilling ; (*v*) Shot core drilling ; (*vi*) Ten tips for successful drilling ; (*vii*) Acker equipment available for core drilling ; and (*viii*) Other Acker equipment. This general approach to a complicated subject succeeds where a welter of technical detail might fail, and good use is made of illustrations.

The diamond core drilling chapter is one of the longest in the book, and is broken down under sub-headings so that each aspect of the subject can easily be located.

W *Cfb Nhe/Cfb Plb*

Encyclopedia of Physics. Crystal Physics II. Handbuch der Physik, Kristallphysik II

S. Fluegge. Springer Verlag, Berlin, Goettingen, Heidelberg. 1958, 273 pp, illustr, tables, subject index in English and German. Price : not known

This is a book for the serious student of crystal physics, which deals with all aspects of its subject exhaustively. The range covered in this volume is that of crystal plasticity and the transformations and growth of the crystal structure. The first section, on crystal plasticity, has an introductory chapter which reviews the remaining deformations to be discussed and the basic conditions of plastic deformation. Alloys are dealt with separately, and a chapter is devoted to annealing and creep.

The second section, on transformations and growth of the crystal structure, contains one chapter on the mechanics of the nucleus-formation in crystals, and a second on the kinetics of special processes, *ie* precipitations, diffusionless transformations, and transformations of irregular atom arrays into regular ones.

Long lists of references are provided for each subject, and two subject indices are provided, one German-English, and the other English-German. These make the book an extremely useful work of reference. It is clearly set out and amply illustrated, the only disadvantage being the thin paper, which, in places, allows the print to show through from one side of the page to the other. *A* *Vh.52*

Statistical summary of the mineral industry—production, exports and imports 1951-1956

Statistical Section of the Mineral Resources Division of Overseas Geological Surveys, HM Stationery Office, London. 1958, 371 pp, tables. Price : £1 7s 6d

The whole of the world's mineral production, including diamonds, is summarized. The period covered is 1951-1956, for which period production, export, and import figures are given. Information on certain countries, notably those of Eastern Europe, is incomplete. Abrasives, other than diamond, aluminium, and diatomaceous earth, are dealt with under a special section. *W* *Bc.13.31/F.13.31*

TRADE LITERATURE

DIAMOND WIRE DRAWING DIES

Diamond die prices, price list No 28B

Diamond Die Service Co, Cartersfield Rd, Waltham Abbey, Essex. 1 p

This firm publishes a series of price lists for their diamond dies which are available in sizes from 0.00059 to 0.116 inch. No illustrated catalogue on diamond dies is provided. *W* *Nkb.252*

Collected catalogues [Indiana wire drawing dies]

Indiana Wire Die Co, 314-324 East Wallace St, Fort Wayne, Ind.

The Du-Al two-way diamond die features a hard beryllium core and additional back relief. The carat weight of the diamond is guaranteed.

An inexpensive re-cutting service is offered to customers, who can also buy diamond powder from the Company. A salvaging, cleaning, and grading service for users of diamond powder is also offered.
W *Hve/Hvf/Hvm/Nkb*

Ajax precision diamond wire dies draw . . . more smiles

Ajax Industrial Supplies Inc, Fort Wayne, Ind. 4 pp, 8½ × 11 in., illustr

The complete process of producing diamond dies is dealt with in this catalogue, and the machinery used in all processes described has been designed and built by the Company.

Test lengths of wire are drawn through all dies produced ; these must be round to four decimal places, and must equal or exceed the customers' specifications. Figures are said to be available to support a statement that out of an examination of diamond dies produced by eight countries, those produced by Ajax were judged to be the highest quality.
W *Hq/Nkb Qd*

Balloffet-Vianney wire drawing dies

Balloffet-Vianney Wire Die Co Inc, 6825 Adams St, Guttenberg, NJ. 7 pp, 5½ × 8½ in., illustr

This company is the only diamond die manufacturer to have won the US Army-Navy 'E' Award three times. The Award is made to companies producing goods of a consistently high quality. In addition to supplying and re-cutting diamond dies, carbide dies are produced as blank dies. The terminology of drawing dies is shown on simple diagrams. Diamond powder for re-cutting or re-polishing diamond dies is available in seven mesh sizes ; the powder is also suitable for fine lapping and fine grinding operations.
W *Nkb*

Kelly Wire Die Corporation

Kelly Wire Die Corp, 19 West 34th St, New York 1, NY. 4 pp, 8½ × 11 in.

Prices and dimensions are given for diamond and carbide wire drawing dies. Other products manufactured by the Company are carbide tube dies and mandrels, standard and special carbide shape dies, cold heading carbide dies, and special deep draw dies.
W *Nkb.252/Pxb.252*

UR—the maximum in output and economy

Joh Urbanek & Co, Frankfurt am Main, Baumweg 45-47, Germany. 12 pp, 4 × 8½ in., illustr

A neatly produced catalogue depicts a wide selection of products of interest to the wire drawing industry. High accuracy diamond dies are produced with bores from 0.00025 to 0.12 inch. Diamond dies are said to be more efficient than carbide dies for drawing hard metals, fine sizes, and wires of high quality. Diamond die polishing machine TNP 53 has 10 spindles for bores from 0.01 to 0.19 in., and features a special needle polishing device.

Tungsten carbide dies and tools, and diamond pastes and applicators, are other products dealt with in this catalogue. *W* *An Cn Nkb/Kmg*

Collected catalogues [Philips diamond dies]

NV Philips Gloeilampenfabrieken, Allied Industries, Eindhoven, Holland ; also available from Mullard Ltd, Mullard House, Torrington Place, London, WC 1

The Philips diamond die factory is the biggest in the world. The dies produced there are available in a wide range of sizes, and a sales follow-up arrangement provides a reconditioning and technical advice service.

The catalogues fully describe the process of diamond die manufacture, and tables give information on the mounting dimensions and diameter tolerances. Two methods of checking wire diameters, *ie* the weight check and the electrical resistance check, are explained. Information is also given on roundness checking and the wear of dies during use. Several excellent enlarged photographs of diamond dies are reproduced.
W *Hq Nkb.57*

Dura tungsten carbide dies and tools ; Adelphi diamond dies

Wire Drawing Dies (Manchester) Ltd, Adelphi Ironworks, Salford 3, Lancs. 10 pp, 7 × 9 in., illustr

Adelphi diamond dies are produced in bore sizes from 0.0004 to 0.10 in. (0.01016 to 2.54 mm), from high quality diamonds. The diamonds are selected to give the maximum thickness around the box, and are produced on machines designed specially to reduce any form of fatigue developing in the diamond during manufacture. The catalogue illustrates the various aspects of diamond die production, and includes a table of wire gauges in SWG, Birmingham or Stubbs, Browne and Sharpe, and Washburne and Moen measurements. A section on tungsten carbide dies and tools is also included. *W* *Fc Hq Nkb/Pxb*

Collected catalogues [die polishing machinery]

The Johnson Metal Company Ltd, 45 Chapel St, Salford 3, Manchester

Various die polishing machines are illustrated, and the polishing methods are briefly described. The relative merits and disadvantages of both the needle and wire types of machine are discussed. Information is given on most aspects of the treatment of diamond and composition dies. *W* *Hqh*Hqj*

Die making equipment and diamond powders in all sizes

Wayne Wire Die Co, 200 Pennsylvania Ave, Hillside, NJ. 4 pp, 8½ × 11 in., illustr

Diamond dies are produced in sizes from 0.0006 to 0.114 in., and tungsten carbide dies from 0.004 to 0.50 inch. Diamond powders are supplied in all sizes. The back of the catalogue shows separate price lists for diamond and tungsten carbide dies, a table of different standards for wire gauges, and a table giving decimal inch equivalents for millimetres and fractions of millimetres. *W* *Km/Nkb/Pxb*

Metals

General Electric Co Ltd, Component Sales Dept, Osram Lamp Works, East Lane, Wembley, Middx. 8½ × 10½ in. 46 pp illustr

The section on diamond wire drawing dies is brief, yet it includes a clear description of the properties required of a diamond die, and also a pictorial representation of the stages of diamond die manufacture. There is an excellent enlarged photograph of a drilled diamond. The dies are available in sizes down to 0.4 mm.

A considerable amount of information on diamond powders is given, and there are sections on tungsten, molybdenum, molybdenum-tungsten alloys, lead wires, filament coils and filament supports, and GEC heavy alloys. *W* *Km/Nkb*

GENERAL

New Model ' SS ' radius dresser outperforms them all

Somerset Tool Co, 238 Virginia St, Hillside, NJ. 4 pp, 8½ × 11 in., illustr

The SS radius truer features a diamond which is set by a conventional micrometer. Damage to the diamond is avoided by means of a hood, and a testing accuracy of 0.0001 in. can be obtained. The diamond is mounted on an adjustable arm which is positioned under the wheel for the forming operation. Forming accuracy is within 0.0002 inch. The truer incorporates a patented device for forming clearance angles on wheels for grinding turning tools. The four types of diamond-point available are : (*i*) natural point ; (*ii*) natural chisel point ; (*iii*) lapped chisel point ; and (*iv*) lapped cone point. *W* *Cg Nj Psfc*

Collected catalogues [diamond drilling equipment]

E. J. Longyear Co, Minneapolis, Minnesota, USA

Catalogue 200 is an introductory catalogue which briefly describes the types of diamond drilling tool available, and which gives general information on diamond sizes, diamond exposure, diamond distribution, ordering, and re-setting. A table of setting specifications is included.

Bulletin 306 shows the Longyear 44 diamond core drill. Full details of performance are given.

Longyear World number 2 relates to the development and use of core barrels in diamond drilling, and a wide range of core barrels is shown.

Bulletin 96 describes a selection of products and services provided by the Company.

W *Cfb Nh.57*

New micro-feed wheel dresser

Nu-Dres Tool Co, 2235 Artesia St, Long Beach 5, Calif. 1 p, 8½ × 10½ in., illustr

The Nu-Dres 100 micro-feed wheel truer has an adjustable diamond holder mounted on a swingable arm. A relief of approximately 0.065 in. can be formed in 5 seconds. Model 200 is mounted on a graduated quadrant. *W* *Ab Cg Nj Psf*

Rocol molybdenised lubricants

Rocol Ltd, Rocol House, Swillington, Nr Leeds. 33 pp, 7⅞ × 10 in., illustr

A complete range of lubricants is described in the catalogue, some of which are recommended for precision engineering, *eg* Molykiron 4. For wire drawing, 0.25% Molypol added to a soluble oil emulsion is reported to extend die life by a factor of 4, at the same time producing a better quality wire with few chatter ridges. *W* *Qr Sk.57*

Technical Bulletin : Improvements to the optical profile grinding machine

Wickman Ltd, Coventry. 6 pp, 8½ × 11 in., illustr

The improvements include a quicker system of work location, a re-designed cylindrical grinding attachment —now designated Mark II, the provision of a 20 : 1 pantograph to special order, an auxiliary table for long template work, and the provision of a small-wheel grinding attachment as an optional extra.

W *Chch Pr*

Sheffield micro-form grinders Models 121 and 122

Sheffield Corp, Dayton 1, Ohio. British rep : Catmur Machine Tool Corp Ltd, 103 Lancaster Rd, London W 11. 8 pp, 8½ × 11 in., illustr

Micro-Form grinders are designed for finish grinding form tools, templates, profile cams, dies, etc, of tungsten carbide and other hard materials. Grinding is controlled by a 50 : 1 pantograph which transmits the movements of a stylus over a 50 : 1 drawing. Both the No 121 and the No 122 are provided with a microscope for checking the work, and the 121 has a 30 power viewing screen. The diamond-impregnated grinding wheel is fed manually so that its cutting edge works towards a point given by the intersection of two crosshairs on the screen or microscope which correspond to the position of the stylus. The maximum drawing size allowable is 20 × 20 inches. A circular grinding mechanism is available which accommodates work up to 5 in. diameter and 6 in. long. Accuracies throughout are in the region of 0.0003 inch.

A Sheffield radius truing device is an optional extra. As the truing operation can be viewed on the microscope or the viewing screen, the condition of the diamond is always apparent.

W *Al Chcb Pr.57*

Collected catalogues [DDSM tools]
DDSM Tools Ltd, Cartersfield Rd, Waltham Abbey, Essex

DDSM diamond drill bits have tungsten carbide inserts reinforcing the leading edges of waterways. A crenellated tongue in the steel bit shank extends into the matrix so that the blank and head form one unit. A special dome profile ensures rapid removal of cuttings.

Tung-tool diamond truing tools use several diamonds equally spaced along the end surface of a slab-shaped 'tongue'. The tongues can be supplied without shanks, and the length of the tongue can be varied to suit special requirements.

A selection of single-point truing tools is available.
W *Nhb.57/Nj.57*

What's all this about the orientation of industrial diamonds ?
Koebel Diamond Tool Co, 9456 Grinnell Ave, Detroit 13, Mich. Folder, 3¼ × 8½ in., illustr

The history and advantages of orienting diamonds in tools are briefly outlined. Of the random-set diamonds in CDP tools, 50% are orientated along maximum hardness directions and 50% vary from the maximum to the minimum. Controlled orientation of diamond particle tools is considered unnecessary and impractical.
W *Fc Ubc:Ld N*

Diamond powders. Diamant-Koernungen
Diamant Verwertungs Gesellschaft mbH, Unter Sachsenhausen 14-26, Koeln am Rhein, Germany. 12 pp, 7⅛ × 9⅞ in. illustr. (In German)

This attractively designed booklet describes diamond powders from every point of view: their manufacture, development, ranges of application, different sizes, and general rules for the most suitable sizes for different applications. Leonardo da Vinci is recognized as the man who realized the future importance of diamond dust in industry. It is said that no article is produced in modern industry which has not come into contact with diamond, directly or indirectly, at some stage in the manufacturing process. A thorough review of the gradual development of the use and preparation of diamond dust follows, with tables giving precise details of mesh size, application, et cetera.
A *Km.526*

Diamond pioneering for more than a quarter century
Koebel Diamond Tool Co, 9456 Grinnell Ave, Detroit 13, Mich. 6 pp folder, 8½ × 11 in., illustr

A brief review of the development of the company and some of the chief products sponsored by it. Among the tools shown are the Multi-Point, Multi-Set, and Multi-Edge diamond truing tools, the Koebelite core drill, and the CDP grinding wheel truer.
A *Nhe/Nj*

PATENT LISTS

BRITISH

The Official Journal (Patents) 1958 (3637) (Oct 29)

806,406 SANDVIKENS JERNVERKS AB. Cutting inserts for rock drill bits.

806,282 BISTERFELD, E. (trading as BISTERFELD & STOLTING). Flexible abrasive wheels.

806,427 TECHNICAL CERAMICS LTD. Drilling of hard brittle materials.

806,496 FORD MOTOR CO LTD. Cemented [sintered] carbides.

The Official Journal (Patents) 1958 (3638) (Nov 5)

806,805 BISTERFELD, E. (trading as BISTERFELD & STOLTING). Grinding tools.

806,753 KENNAMETAL INC. Cutting tool with replaceable cutting insert.

806,626 LUMENITE (PTY) LTD. Abrasive wheel cutting-off machines.

806,629 FORTUNA-WERKE SPEZIALMASCHINEN-FABRIK AG. Process and apparatus for dressing grindstones.

The Official Journal (Patents) 1958 (3639) (Nov 12)

807,066 TAYLOR, H. Grinding or polishing machines.

807,063 GEAR GRINDING MACHINE CO. Truing or shaping mechanisms for the grinding wheels of gear-grinding machines.

807,190 UNTERNEHMUNGEN DER EISEN- UND STAHLINDUSTRIE AG FUER. Rotary cutter for drilling earth and rock.

807,064 GEAR GRINDING MACHINE CO. Exchangeable cutter units and mountings therefor, for use in truing or shaping mechanisms for the grinding wheels of form grinding machines.

The Official Journal (Patents) 1958 (3640) (Nov 19)

807,401 HALLEWELL, H. S. Mounting for forming means for profile grinding wheels.

807,274 BISTERFELD, E. (trading as BISTERFELD & STOLTING). Manufacture of hollow cylindrical abrasive members.

807,317 SCRIVENER LTD, A., and ADAMS, A. E. Feed mechanism for a centreless grinding machine.

807,250 WINTER, W. Grinding or lapping wheels.

807,420 SKANDINAVISKA GRANIT AB. Stone sawing machine.

UNITED STATES

Official Gazette 1958 Vol 735 (1-4) (Oct)

Re 24,548 J. R. ERICKSON, NORTON CO. Cut-off wheel.

2,854,736 K. M. TAYLOR, CARBORUNDUM CO. Boron nitride-metal silicide bodies and the manufacture thereof.

2,854,794 R. L. LUEDEMAN, DAYSTROM INC. Treating sapphire objects of irregular shapes.

2,854,966 W. LADINSKY. Diamond truing devices for abrasive cutters.

2,855,181 O. K. OLSEN. Drill bits.

2,858,189 L. H. LEWIS, CONCRETE MFG CO. Concrete sawing machine for making parallel grooves.

2,855,316 K. M. TAYLOR, CARBORUNDUM CO. Boron nitride shapes and method of making.

2,855,729 E. F. RENDER, CINCINNATI MILLING MACHINE CO. Grinding machine.

2,855,730 J. E. FERGUSON, RISDON MFG CO. Methods and apparatus for producing decorative finishes on articles.

2,855,731 C. STELMACHOWSKI, SUPER-CUT INC. Truing device for peripheral type grinding wheels.

2,855,733 H. V. ALLISON, AMERICAN CHAIN & CABLE CO INC. Abrasive cutting wheel method.

2,855,734 A. GURSCH, ASKANIA-WERKE AG. Method of centring and grinding edges of optical lenses.

2,855,917 A. A. BERG. Dressing attachment for surface grinders.

2,856,914 J. T. DESSUREAU, J. B. DESSUREAU. Stone sawing wire.

2,857,671 M. E. NELSON. Dental grinding attachment.

2,857,716 F. J. WOIDKA, SAGINAW MACHINE & TOOL CO. Grinding apparatus.

2,857,719 A. A. MILLER, C. CASANOV. Grinding wheels.

2,858,256 F. FAHNOE, J. J. SHYNE, VITRO CORP OF AMERICA. Electro-phoretic method of making an abrasive article, and article made thereby.

SOUTH AFRICA

Official Journal 1958 Vol 11 (38-42) (Sep-Oct)

3265/57 R. P. M. HOLLIDAY, WICKMAN (SOUTH AFRICA) (PTY) LTD. Bits for combined rotary and percussive drilling.

3265A/57 R. P. M. HOLLIDAY, WICKMAN (SOUTH AFRICA (PTY) LTD. Drill bits.

3594/57 R. P. M. HOLLIDAY, WICKMAN (SOUTH AFRICA) (PTY) LTD. Percussive rock drills.

1976/58 L. H. METZGER, H. C. MILLER, SUPER-CUT INC. Method of and apparatus for dressing grinding wheels.

2069/58 E. H. KURT, R. L. THOMPSON. INGERSOLL-RAND CO. Rock drill.

1477/58 P. M. McKENNA, KENNAMETAL INC. Drilling tool and method of manufacture thereof.

2143/58 A. BEARD, C. H. BOOTH, SIMMONDS AEROCESSORIES LTD. Cutting or abrading tools.

SWISS

Patentliste 1958 (18-19) (Sep-Oct)

322,885 E. BORER, MANUFACTURE DES MONTRES ROLEX, AEGLER SA. Balance shaft for watches and method of its manufacture.

332,894 E. BORER, MANUFACTURE DES MONTRES ROLEX, AEGLER SA. Shock absorbing bearing for watch movements and method for its manufacture.

332,907 A. PAUDRAT. Method for obtaining an improvement in the cutting speeds of carbon steels and ferrous alloys as well as increased wear resistance and a reduction of their coefficient of friction.

332,922 NATIONAL CASH REGISTER CO. Method of profiling a grinding wheel and device for carrying out this method.

333,120 H. FEHLMANN. Device for sawing hard materials.

333,262 L. I. HISING, UDDEHOLMS AB. Hard metal alloy and method for its manufacture.

333,268 M. WIEDEMANN, AG FUER MASCHINENBAU. Device on machine tools for machining workpieces in a liquid bath, in particular for machining conductive materials by electro-erosion.

333,285 H. AMRHEIN, E. LANDECK, FRITZ WENDT KG. Method and device for working surfaces, in particular for precision grinding.

333,287 O. AMIET, CHRISTEN & CIE AG. Apparatus for sharpening drills by means of a grinding wheel.

FRENCH

Bulletin Officiel 1958 Vol 75 (3885-88) (Oct-Nov)

1,169,580 TRU-SCALE, INC. Apparatus for abrading the surfaces of foils of plastic material.

1,169,590 G. H. FETTERLEY, CIE DES MEULES NORTON. Method of producing borides.

1,169,953 UNION CARBIDE AND CARBON CORP. Welding compositions for securing hard metal tips.

1,170,619 G. DUBOIS. Method and device for making surfaces of revolution with elliptical generatrix.

1,170,648 L. NUSSBAUM. Method of making workworkpieces of hard carbides.

1,170,892 NEWALL ENGINEERING CO LTD. Grinding machines.

1,170,919 ASSOCIATED ELECTRICAL INDUSTRIES LTD. Method of making semiconductor junctions.

1,171,398 W. TIRASPOLSKY, R. F. RONVIERE, J. CHARE. Turbine for earth boring.

1,171,452 OREGON SAW CHAIN CORP. Saw with articulated teeth and method of grinding them.

1,171,478 LANDIS TOOL CO. Grinding wheel for turbine blades.

1,171,887 GEAR GRINDING MACHINE CO. Mechanism for profiling grinding wheels.

GERMAN

Patentblatt 1958 Vol 78 (44-47) (Oct-Nov)

Applications Open to Public Inspection

1,042,247 K. SIEPMANN, FERNSEH GmbH. Device for measuring workpiece tolerances.

1,042,272 P. FUCHS, ERSTE NAXOSSCHMIRGEL-FABRIK DEUTSCHLANDS. Testing apparatus for granular material bonded with natural or synthetic means.

1,042,415 FRITZ WENDT KG. Device for machining surfaces.

1,042,417 K. KRUG, H. MAEDRICH, DISKUS WERKE FRANKFURT a MAIN AG. Measuring control of a surface grinder with a rotating work table.

1,042,419 C. KLINGSPOR. Method for making grinding wheels whose grinding faces consist of a ring of leaves carrying abrasive grains.

1,042,449 WIEDES CARBIDWERK FREYUNG mbH. Method of making bodies of high melting metal and high melting metal oxide and the use of these bodies as an abrasive.

1,042,451 C. A. REDFARN. Abrasive body and method for its manufacture.

1,043,856 A. J. LAVAUD, MARTIN & CIE. Tool grinding machine.

1,043,859 K. GEPPERT, KUGELFISCHER GEORG SCHAEFER & CO. Device for forming crumbly abrasive material by compacting and pressing into grinding wheels.

1,044,365 A. J. C. HALL, J. G. HAYES, COMMONWEALTH OF AUSTRALIA. Method of producing scales, patterns, and the like in glass.

1,044,663 G. PACHMANN, G. STEUDT, VEB TRANSFORMATORENWERK KARL LIEBKNECHT. Device for grinding magnetisable balls and for grinding-in magnetisable balls in ball valves.

Patents Granted

971,040 F. S. CRANE, MARTIN-DECKER CORP. Hydraulic feeler gauge for load indicators.

971,051 R. FARINES. Device for piercing synthetic jewels (bearing stones) consisting of hard dielectric material.

TRADE NAMES INDEX 1959

The Trade Names Index for 1959, to be compiled jointly by the Industrial Diamond Information Bureau and *Industrial Diamond Review*, is now in preparation. It will replace the 1954 issue, and will continue to provide a useful service for manufacturers and users of d

Manufacturers of diamond tools, l ics, and materials for the precision engi and return it not later than February 28th as shown and posted as soon as possible.

Publication date is Autumn, 1959, and orders should be placed early.

You have already received one of these. . .

Title of Company	
Address	
Products (with trade name in brackets)	

You should now be thinking of returning it to the address shown on the reverse side.

* * *

The *Industrial Diamond Trade Names Index* is the only work of reference in the world which lists solely those companies dealing in diamond tools and fine machining equipment.

* * *

To ensure that *your* company appears in the 1959 edition, you should return the completed form *before* March.

* * *

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'HABIT'

a journal for precision engineers and all users of industrial diamonds and other hard materials

INDUSTRIAL DIAMOND REVIEW

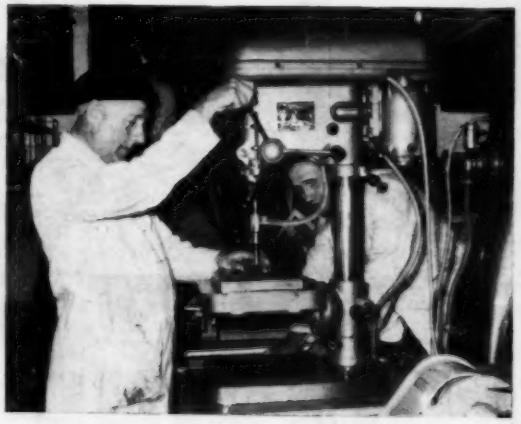
incorporating INDUSTRIAL DIAMOND ABSTRACTS

MONTHLY 1/3 SUBSCRIPTION 15/- A YEAR

January, 1959 Vol. 19 No. 218

A DEMONSTRATION?

IF YOU CUT, drill or grind glass, ceramics, carbide or any known hard material the Neven Mobile Unit will demonstrate most efficient production methods with diamond tools. May we send this Demonstration Unit to your works? The Sales Manager would be pleased to advise you when the Unit will be in your area.



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